NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY

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NGA STANDARDIZATION DOCUMENT

NATIONAL IMAGERY TRANSMISSION FORMAT VERSION 2.1

Implementation Profile

for

Tactical Light Detection and Ranging (LiDAR) Systems

Specification of the data content, structure and metadata
for tactical LiDAR data products

(2010-09-07)

Version 1.0

NATIONAL CENTER FOR GEOSPATIAL INTELLIGENCE STANDARDS

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IMPORTANT NOTICE

A hardcopy of this document may not be the version currently in effect. The current version is available at the following web-address: https://nsgreg.nga.mil. The current version can always be verified on the web prior to using this document.

REFERENCES

The reference documents listed in this section consist of existing standards, guidelines, and handbooks published by various organizations of the United States government, the North Atlantic Treaty Organization (NATO), international standards bodies, non-governmental technical organizations, and, in some cases, private and public corporations.

While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited by this implementation profile document, whether or not they are listed here. At the time of publication, the editions indicated in the following tables were valid. All documents are subject to revision and users of this profile document should investigate recent editions and change notices of the documents listed below.

DEPARTMENT OF DEFENSE STANDARDS	
MIL-STD-2500C	DoD Interface Standard National Imagery Transmission Format Version 2.1 for the National Imagery Transmission Format Standard, 01 May 2006
MIL-STD-188-198A	Joint Photographic Experts Group (JPEG) Image Compression for the National Imagery Transmission Format Standard, 15 Dec 1993 – through CN4 (31 Mar 2004)

FEDERAL INFORMATION PROCESSING STANDARDS	
FIPS PUB 10-4	Countries, Dependencies, Areas of Special Sovereignty, and Their Principal Administrative Divisions, Apr 1995 NOTE: Effort is underway to transition from use of FIPS10-4 country codes to those of ISO 3166-1.

NATO STANDARDISATION AGREEMENTS	
STANAG 4545	Standardization Agreement 4545, NATO Secondary Imagery Format (NSIF), Edition 1, Amendment 1, 14 April 2000, with Errata Sheet dated 1 May 2007

NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY PUBLICATIONS	
STDI-0002	The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITFS) Version 3.0, 1 August 2007
STDI-0005	Implementation Practices of the National Imagery Transmission Format Standard (IPON) Version 1.0, 1 August 2007
STDI-0006	National Imagery Transmission Format (NITF) Version 2.1 Commercial Dataset Requirements Document (NCDRD), 23 July 2008.

TR 8350.2	Department of Defense World Geodetic System 1984, Third edition, 04 Jul 1997 with Amendment 1 (03 Jan 2000) and Amendment 2 (23 Jun 2004)
N-0105/98	National Imagery Transmission Format Standard (NITFS) Standards Compliance and Interoperability Test and Evaluation Program Plan, 25 Aug 1998
N0106-97	National Imagery Transmission Format Standard Bandwidth Compression Standards and Guidelines Document, 25 Aug 1998

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION	
ISO 3166-1	Codes for the representation of names of countries and their subdivisions – Part 1: Country codes
ISO/IEC IS 12087-5	Information technology – Computer graphics and image processing – Image processing and interchange (IPI) – Functional specification – Part 5: Basic image interchange format (BIIF), 01 Dec 1998
ISO/IEC 15444-1:2004	Information technology – JPEG 2000 image coding system – Part 1: Core Coding System
BPJ2K01.10	Information technology – Computer graphics and image processing – registered graphical item – Class: BIIF Profile – BIIF Profile for JPEG 2000 Version 01.10 (BPJ2K01.10)
ISO/IEC BIIF PROFILE NSIF01.00	Information technology – Computer Graphics and Image Processing – Registered Graphical Item, Class: BIIF Profile – NATO Secondary Imagery Format Version 01.01. June 2008

INSTITUTE OF ELECTRICAL & ELECTRONICS ENGINEERS STANDARDS	
IEEE 754	IEEE Standard for binary floating-point arithmetic

COMMERCIAL STANDARDS	
LAS 1.2	LAS Specification, Version 1.2 – September 2, 2008 (http://www.asprs.org/society/committees/standards/lidar_exchange_format.html)
LAS 1.3	LAS Specification, Version 1.3 – July 14, 2009 (http://www.asprs.org/society/committees/standards/lidar_exchange_format.html)

ACRONYMS

The Acronyms used in this document are defined as follows:

BCS-A – Basic Character Set – Alphanumeric
BCS-N – Basic Character Set – Numeric
DES – Data Extension Segment
ECS-A – Extended Character Set – Alphanumeric
FTITLE – File Title
HDR – File Header
ICD – Interface Control Document
IID2 – Image Identifier 2
JPEG – Joint Photographic Experts Group
IM – Image Segment
LiDAR – Light Detection and Ranging
NITF – National Imagery Transmission Format
NSG – National System for Geospatial-Intelligence
NSIF – NATO Secondary Imagery Format
TAC ID – TACtical image IDentifier
TRE – Tagged Record Extension

Additional acronyms may be found in the following reference documents:

- *MIL-STD-2500C, DoD Interface Standard National Imagery Transmission Format Version 2.1 for the National Imagery Transmission Format Standard;* Section 3.1
- *STDI-0002, The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITFS);* Appendix A
- *STDI-0005, Implementation Practices of the National Imagery Transmission Format Standard (IPON);* Appendix A
- *STDI-0006, National Imagery Transmission Format (NITF) Version 2.1 Commercial Dataset Requirements Document (NCDRD);* Section 5
- *LAS Specification, Version 1.2 – September 02, 2008 (http://www.asprs.org/society/committees/standards/lidar_exchange_format.html)*
- *LAS Specification, Version 1.3 – July 14, 2009 (http://www.asprs.org/society/committees/standards/lidar_exchange_format.html)*

CONTACTS

The following points of contact are provided for assistance in understanding the contents of this implementation profile.

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CHANGE LOG

Date	Version	Description	DR/CA	Developer
07 SEP 2010	1.0	Initial publication.	N/A	NGA ID and NCGIS

TBR/TBD LOG

Page Number	TBD/TBR	Description	Date Addressed
122	TBR01	The target JPEG 2000 bit rate values provided in Table 4.1.10-2 have not been optimized for LiDAR systems. The values may be used until such time as additional research identifies LiDAR-specific values.	

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1.0 Introduction

This implementation profile (IP) describes the NITF2.1 image file formats and metadata profiles for the various products generated by Tactical Light Detection and Ranging (hereafter referred to as LiDAR) systems and their ground processing elements.

This IP provides the descriptions of the NITF2.1-formatted LiDAR datasets that are suitable for ingest into, and dissemination through, the National System for Geospatial-Intelligence (NSG).

1.1 Purpose

This IP provides working definitions of the NITF2.1 formats when the NITFS is used to describe various LiDAR datasets. This document also serves as an informative guide for end-users of NITF2.1-formatted LiDAR datasets with respect to default softcopy display and dataset utility.

1.2 Scope

The current scope of this IP is to support the initial development and implementation of NITF2.1-compliant dataset profiles for point cloud and raster LiDAR products. This specification is focused on LiDAR data collected via tactical airborne sensors. This specification promotes the use of the LAS file *data* structure within the NITF2.1 file format, supplemented with a raster representation to facilitate storage, discovery, visualization and retrieval of LiDAR point cloud data from collection sources. The NITF2.1 file structure also allows for storage of additional associated metadata not available in the existing version of the LAS format. The supplemental raster in the NITF2.1 image segment(s) is not intended to be exploited by typical electronic light table software. The supplemental raster data is a descriptive portrayal of the content of the LAS-formatted point cloud data. The embedded LAS file in the LiDAR DES should be extracted from the NITF file for exploitation using LiDAR tools designed to work with the LAS format.

This profile does not address the NITF representation of LiDAR datasets that have been edited, reprocessed, enhanced, supplemented or otherwise modified by downstream processes (e.g. image library, dissemination, screening, workstation and similar processes that may modify, augment and re-save the content of NITF files.

2.0 General Requirements

This IP describes the format and metadata value ranges used in the formation of NITF2.1 LiDAR datasets. LiDAR datasets provided in the NITF2.1 product file formats defined herein are readily accessible via the current architecture of the NSG. To ensure compatibility, interoperability, and integration, systems generating NITF2.1 LiDAR datasets must be tested to ensure compliance with the applicable standards. The

generalized structure of the NITF2.1 files defined in this IP take the form of a single NITF Header (HDR) followed by one or more NITF Image Segments (IM) and ending with one or more NITF Data Extension Segments (DES). Figure 2-1 provides a high-level picture of this general file structure.

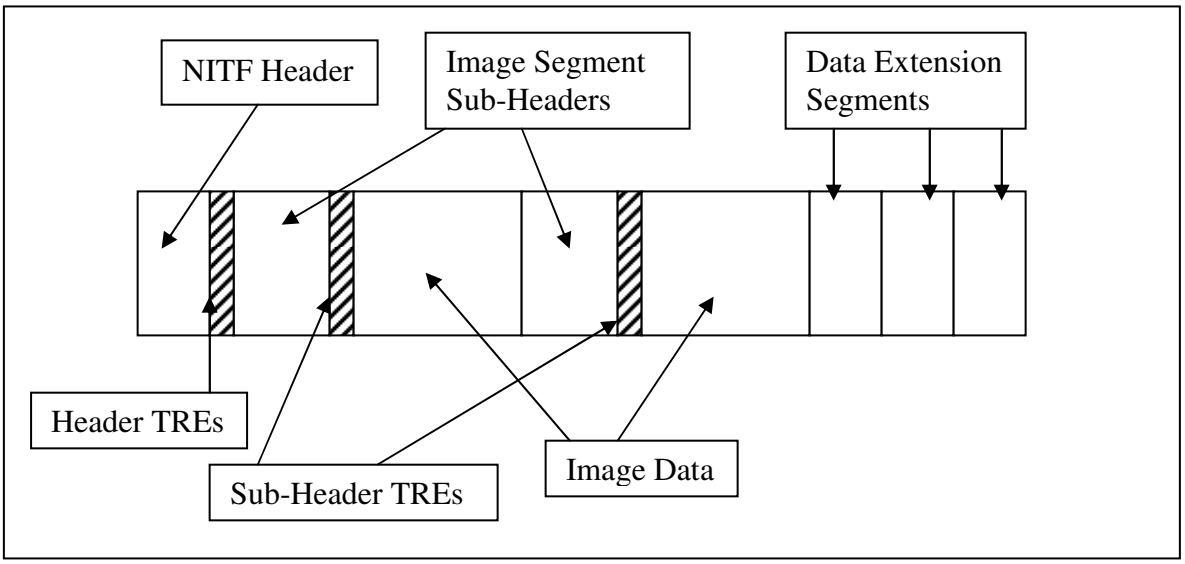

Figure 2-1: General NITF2.1 File Structure.

The current version of this IP does not make use of Graphic Segments, Text Segments, or Reserved Extension Segments; though this does not preclude the use of these NITF structures in future versions of this standardized profile.

See the individual LiDAR (section 3.0) product description sections for discussion of the specific types and numbers of NITF structures used for a given product dataset. All relevant Tagged Record Extensions (TRE) are discussed generally in the individual dataset descriptions, as well as specifically in section 4.0.

The Tactical Image Identifier (TAC ID) in section 2.1 specifies the file naming convention for LIDAR datasets. Acceptable file naming extensions for use with these LiDAR NITF2.1 datasets include, but are not limited to, the following values: ".ntf", ".nitf", ".ntf21", ".nitf21", ".NTF", ".NITF", ".NTF21", and ".NITF21". A lack of file extension is also permitted.

2.1 Tactical Image Identifier

Table 2-1 defines the Tactical Image Identifier (TAC ID) definitions to be used with the various NITF2.1-formatted LiDAR data products. The TAC ID is used as the NITF2.1-formatted LiDAR data product filename, the value placed into the NITF2.1 Header field, FTITLE, and the value placed into the NITF2.1 Image Segment Subheader field, IID2. This 40-character file identifier is used for cataloging and discovery purposes within the NSG architecture.

The information in Table 2-1 is extracted from STDI-0005 and provided herein as a convenience for the user of this profile. STDI-0005 contains the authoritative specification for Tactical Image Identifier.

For additional information refer to *STDI-0005, Implementation Practices of the National Imagery Transmission Format Standard (IPON).*

Table 2-1: Tactical Image Identifiers for LiDAR Datasets.

Tactical Image Identifiers for LiDAR Datasets.					
IID2 Bytes	**Subfield Name**	**Subfield Description**	**Data Type**	**Value Range**	**Type**
1-7	ACQUISITION _DATE	**Acquisition Date**. This is the image collection date and **not** the start of mission date or aircraft takeoff date. DD is the day of the month, MMM is a three letter abbreviation of the month, JAN, FEB,…DEC (uppercase), YY is the least significant 2 digits of the year Note: This is the same date (different format) as recorded in the Image Subheader IDATIM field	BCS-A	DDMMMYY (for all products)	R
8-9	PROGRAM _CODE	**Program Code**. Assigned by Operations (e.g. CAOC). This value is the same as the first 2 characters of the Mission ID. Note: There is no common authoritative reference for operational assignment of Mission IDs. A frequently used reference is NSG Directive 2-1, Exploitation and Reporting Structure (EARS).	BCS-A	0-9, A-Z (uppercase) 1st char is numeric 2nd char is alphabetic -OR- 1st char is alphabetic 2nd char is numeric	R
10-11	SORTIE_NO	**Sortie Number**. Assigned by Operations. Last two characters of sortie number of the month.	BCS-A	0-9, A-Z (uppercase)	R
12-16	SCNUM	**Scene Number**. Identifies the current scene, and is determined from the mission plan, except for ad hoc “re-tasking” or “immediate scenes”. Scene numbers do not have to be sequential, only unique. See paragraph J.3.3 of the IPON (STDI-0005) for further details.	BCS-N	00000-99999	R
17-18	PRODUCER _CODE	**DoD/DIA Producer Code**. Uniquely defines a producer per site. Site designation.	BCS-A	AA-ZZ (uppercase)	R
19-24	PRODUCT _NO	**Product Number**. “Producer-defined” product ID number which uniquely defines each product produced by a given producer. This could be a simple one-up product sequence number. E.g. the CIP Product Number is comprised of three separate subfields: a processing configuration number (1 char, 0-F), a product type ID (2 chars, 01-FF), and a product sequence number (3 chars, 000-FFF); for CIP processing configuration = 1, product type ID = 12, and product sequence number = 25; then the PRODUCT_NO = 10C019 (hex).	BCS-A	0-9, A-Z (uppercase)	R

Tactical Image Identifiers for LiDAR Datasets.					
IID2 Bytes	**Subfield Name**	**Subfield Description**	**Data Type**	**Value Range**	**Type**
25-26	PROJECT _CODE	**Project Code**. Two-character NGA assigned project code.	BCS-A	AA-ZZ (uppercase)	R
27-29	REPLAY	**Replay Indicator**. Indicates whether the data was reprocessed or retransmitted. See paragraph J.3.1 of the IPON (STDI-0005) for additional discussion. 000: original C01: DCGS-I Look Composite C02: DCGS-I Volume Composite G01-G99: Reprocessed Image T01-T99: Retransmitted Image	BCS-A	000, C01, C02, G01-G99, T01-T99	R
30-32	PRODUCER _SN	**Producer Serial Number**. Defines a unique instance of the primary image producer (e.g. processor). Note: Represented as either a decimal or a hexadecimal value.	BCS-A	000-FFF (No spaces allowed)	R
33-40	PRODUCTION _DATIM	**Production Date and Time**. Eight-character (hex) production date/time (GMT represented in hexadecimal as elapsed time in seconds since midnight Jan 1, 1970. Note: This date & time should be equivalent to, or within 5 seconds of the NITF2.1 header field, FDT, and the PIAPRx field, PRODUCRTIME, (format is different). Any transaction, change, modification, and/or editing of the image segment (subheader and/or pixels) requires updating characters 33-40 of the Tactical Image ID (PRODUCTION_DATIM) to reflect the date/time of the processing action. Anytime a processor edits & resaves a NITFS IM segment that has the new Tactical Image ID, it must update the subfield for PRODUCTION_DATIM (bytes 33-40). If the image segment is resaved unmodified (“as is”) or as part of another NITF file (e.g. accumulated into a volume in a NITF file with MITOCA), then the PRODUCTION_DATIM subfield does not need to be updated. See paragraph J.3.2 of the IPON (STDI-0005) for reduced resolution data sets (Rsets).	BCS-A	00000000-FFFFFFFF (hexadecimal value of seconds from midnight Jan 1, 1970; a.k.a. UNIX time) Note: Alpha-characters shall be upper-case.	R

3.0 LiDAR NITF2.1 Requirements

3.1 Restrictions

The following conventions will be adhered to in terms of image segment and data extension segment population. A LiDAR NITF2.1 file must contain at least one image segment. That segment must contain either a gridded Intensity product (Section 3.2.3) or a gridded Elevation product (Section 3.2.4). The file may contain both types of products, if desired. In addition to the required image segment, a LiDAR point cloud saved in binary LAS format shall be included by storing it in one or more LIDARA data extension segments (Section 3.2.5). The data contained within the LAS file must be the source of the included Intensity and Elevation products. The principal purpose of the Intensity and Elevation products is to facilitate storage, discovery, visualization and retrieval of the LiDAR point cloud data.

3.2 LiDAR Product Definition Profiles

The following conventions will be adhered to in terms of metadata population. For metadata formatted as "Basic Character Set – Alphanumeric" (BCS-A) the values provided in Tables 3.2.1-1 thru 4.1.10-1 shall be post-pended with blank spaces (0x20) as needed to fill the full byte size of the field. Likewise, for metadata formatted as "Extended Character Set – Alphanumeric" (ECS-A) the values provided in Tables 3.2.1-1 thru 4.1.10-1 shall be post-pended with blank spaces (0x20) as needed to fill the full byte size of the field. In contrast, for metadata formatted as "Basic Character Set –Numeric" (BCS-N) the values provided in Tables 3.2.1-1 thru 4.1.10-1 shall be pre-pended with leading zeros (0x30) as needed to fill the full byte size of the field.

Metadata fields in Tables 3.2.1-1 thru 4.1.10-1 having a TYPE designator of "R" are considered to be required fields that must be present in the NITF2.1 dataset. Additionally, fields having this TYPE designation must also be populated with valid data. If the TYPE designator is given as "<R>", then the required field may be populated with a default value of all blank spaces (0x20), regardless of any other directions given in the VALUE RANGE section of the table. If the TYPE designator is given as "O", then the required field may be populated with a default value of all blank spaces (0x20), regardless of any other directions given in the VALUE RANGE section of the table. The presence of a field having a TYPE designator of "C" is conditional on a value(s) in other metadata fields. If present in the file, then metadata fields of TYPE "C" must contain valid data. A TYPE designator of "<C>" also allows the conditional field to be populated with all blank spaces (0x20) as appropriate.

3.2.1 LiDAR Product NITF2.1 Security Fields Description

This NITF2.1 profile for LiDAR products requires compliant NITFS Security Fields as defined in MIL-STD-2500C and existing security marking polices in effect at the time of file creation or modification. Table 3.2.1-1 provides the specific implementation of the NITF2.1 Security Fields for use with LiDAR datasets.

For additional information refer to *MIL-STD-2500C, DoD Interface Standard National Imagery Transmission Format Version 2.1 for the National Imagery Transmission Format Standard, LAS Format, Version 1.2* and *LAS Format, Version 1.3*. Permitted values for NITF header, subheader and TRE fields are subject to extension via registration. See the Official Listing of NITF Registered Field Values at: http://jitc.fhu.disa.mil/nitf/reg_fields.html

Table 3.2.1-1: NITF2.1 Security Fields for LiDAR Products.

NITF2.1 Security Fields for LiDAR Products.						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
xSCLAS	**File Part Security Classification**. This field shall contain a valid value representing the classification level of the entire file.	1	ECS-A	T, S, C, R, or U *For fields xSCLAS through xSCTLN, consult current security guidelines and directives at the time of production to determine proper markings.*	N/A	R
xSCLSY	**File Part Security Classification System**. This field shall contain valid values indicating the national or multinational security system used to classify the file. *Note: See http://jitc.fhu.disa.mil/nitf/tag_reg/fileheader/fsclsy.html for register of codes added via the NTB registration process.*	2	ECS-A	(Default is ECS spaces (0x20))	N/A	<R>
xSCODE	**File Part Codewords**. This field shall contain a valid indicator of the security compartments associated with the file.	11	ECS-A	(Default is ECS spaces (0x20))	N/A	<R>
xSCTLH	**File Part Control and Handling**. This field shall contain valid additional security control and/or handling instructions (caveats) associated with the file. *Note: See http://jitc.fhu.disa.mil/nitf/reg_fields.html and STDI-0005 IPON for info on CH code value handling.*	2	ECS-A	(Default is ECS spaces (0x20))	N/A	<R>
xSREL	**File Part Releasing Instructions**. This field shall contain a valid list of country and/or multilateral entity codes to which countries and/or multilateral entities the file is authorized for release.	20	ECS-A	(Default is ECS spaces (0x20))	N/A	<R>
xSDCTP	**File Part Declassification Type**. This field shall contain a valid indicator of the type of security declassification or downgrading instructions that apply to the file.	2	ECS-A	DD, DE, GD, GE, O, X (Default is ECS spaces (0x20))	N/A	<R>
xSDCDT	**File Part Declassification Date**. This field shall indicate the date on which a file is to be declassified if the value in File Declassification Type is DD.	8	ECS-A	CCYYMMDD (Default is ECS spaces (0x20))	UTC	<R>

NITF2.1 Security Fields for LiDAR Products.						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
xSDCXM	**File Part Declassification Exemption**. This field shall indicate the reason the file is exempt from automatic declassification if the value in File Declassification Type is X. *Note: See http://jitc.fhu.disa.mil/nitf/tag_reg/fileheader/fsdcxm.html for register of codes added via the NTB registration process.*	4	ECS-A	(Default is ECS spaces (0x20))	N/A	<R>
xSDG	**File Part Downgrade**. This field shall indicate the classification level to which a file is to be downgraded if the values in File Declassification Type are GD or GE.	1	ECS-A	S, C, R (Default is ECS spaces (0x20))	N/A	<R>
xSDGDT	**File Part Downgrade Date**. This field shall indicate the date on which a file is to be downgraded if the value in the File Declassification Type is GD.	8	ECS-A	CCYYMMDD (Default is ECS spaces (0x20))	Date	<R>
xSCLTX	**File Part Classification Text**. This field shall be used to provide additional information about file classification to include identification of a declassification or downgrading event if the values in File Declassification Type are DE or GE. It may also be used to identify multiple classification sources and/or any other special handling rules.	43	ECS-A	(Default is ECS spaces (0x20))	N/A	<R>
xSCATP	**File Part Classification Authority Type**. This field shall indicate the type of authority used to classify the file. Valid values are O (original classification authority), D (derivative from a single source), and M (derivative from multiple sources	1	ECS-A	O, D, M (Default is ECS spaces (0x20))	N/A	<R>

NITF2.1 Security Fields for LiDAR Products.						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
xSCAUT	**File Part Classification Authority**. This field shall identify the classification authority for the file dependent upon the value in FSCATP. Values are user defined free text which should contain the following information: original classification authority name and position or personal identifier if the value in FSCATP is O; title of the document or security classification guide used to classify the file if the value in FSCATP is D; and Derive-Multiple if the file classification was derived from multiple sources and the value of the FSCATP field is M. In the latter case, the file originator will maintain a record of the sources used in accordance with existing security directives. One of the multiple sources may also be identified in File Classification Text if desired.	40	ECS-A	(Default is ECS spaces (0x20))	N/A	<R>
xSCRSN	**File Part Classification Reason**. This field shall contain values indicating the reason for classifying the file. *Note: See http://jitc.fhu.disa.mil/nitf/tag_reg/fileheader/fscrsn.html for register of codes added via the NTB registration process.*	1	ECS-A	A to H, M, N (Default is ECS spaces (0x20))	N/A	<R>
xSRDT	**File Part Security Source Date**. This field shall indicate the date of the source used to derive the classification of the file. In the case of multiple sources, the date of the most recent source shall be used. Format	8	ECS-A	CCYYMMDD (Default is ECS spaces (0x20))	UTC	<R>
xSCTLN	**File Part Security Control Number**. This field shall contain a valid security control number associated with the file. The format of the security control number shall be in accordance with the regulations governing the appropriate security channel(s).	15	ECS-A	(Default is ECS spaces (0x20))	N/A	<R>

3.2.2 LiDAR Product NITF2.1 Header Description

This NITF2.1 profile for LiDAR products requires a compliant NITFS Header as defined in MIL-STD-2500C. Table 3.2.2-1 provides the specific implementation of a NITF2.1 Header for use with LiDAR datasets.

For additional information refer to *MIL-STD-2500C, DoD Interface Standard National Imagery Transmission Format Version 2.1 for the National Imagery Transmission Format Standard.*

Table 3.2.2-1: NITF2.1 Header Fields for LiDAR Products.

NITF2.1 Header Fields for LiDAR Products.						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
FHDR	**File Profile Name**. This field shall contain the BCS-A character string uniquely denoting that the file is formatted using NITF. The valid value for this field is NITF for NITF2.1 and NSIF for NSIF1.0.	4	BCS-A	NITF (for NITF2.1)	N/A	R
FVER	**File Version**. This field shall contain a BSC-A character string uniquely denoting the version. The valid value for this field is 02.10 for NITF2.1 and 01.00 for NSIF1.0.	5	BCS-A	02.10 (for NITF2.1)	N/A	R
CLEVEL	**Complexity Level**. This field shall contain the complexity level required to interpret fully all components of the file. Valid entries are assigned in accordance with complexity levels established in Table A-10 of MIL-STD-2500C.	2	BCS-N	03, 05, 06, 07, or 09 (generate as appropriate)	N/A	R
STYPE	**Standard Type**. Standard type or capability. A BCS-A character string BF01 that indicates that this file is formatted using ISO/IEC IS 12087-5.	4	BCS-A	BF01	N/A	R
OSTAID	**Originating Station ID**. This field shall contain the identification code or name of the originating organization, system, station, or product. It shall not be filled with BCS spaces (0x20).	10	BCS-A	alphanumeric	N/A	R
FDT	**File Date and Time**. This field shall contain the time (UTC) (Zulu) of the file's origination in the format CCYYMMDDhhmmss, where CC is the century (00 to 99), YY is the last two digits of the year (00 to 99), MM is the month (01 to 12), DD is the day (01 to 31), hh is the hour (00 to 23), mm is the minute (00 to 59), and ss is the second (00 to 59). UTC is assumed to be the time zone designator to express the time of day. Note that leap seconds are not provided for.	14	BCS-N	CCYYMMDDhhmmss	UTC	R
FTITLE	**File Title**. This field shall contain the title of the file or shall be filled with ECS spaces (0x20). This field shall contain the Tactical Image ID for the LiDAR sensor as given in Table 2-1 above.	80	ECS-A	Tactical ID (see Table 2-1) Default is all spaces (0x20)	N/A	<R>
FSCLAS Through FSCTLN	**For Security Fields FSCLAS through FSCTLN refer to Section 3.2.1 for details.**	167	ECS-A	See paragraph 3.2.1 and Table 3.2.1-1.	N/A	R

NITF2.1 Header Fields for LiDAR Products.						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
FSCOP	**File Copy Number**. This field shall contain the copy number of the file. If this file is all BCS zeros (0x30), then it shall imply that there is no tracking of numbered file copies.	5	BCS-N	00000 to 99999 Default is all zeros (0x30)	N/A	R
FSCPYS	**File Number of Copies**. This field shall contain the total number of copies of the file. If this field is all BCS zeros (0x30), then it shall imply that there is no tracking of numbered file copies.	5	BCS-N	00000 to 99999 Default is all zeros (0x30)	N/A	R
ENCRYP	**Encryption**. This field shall contain the value BCS zero (0x30) until such time as the MIL-STD-2500C specification is updated to define the use of other values.	1	BCS-N	0 (for not encrypted) Default is a zero (0x30)	N/A	R
FBKGC	**File Background Color**. This field shall contain the three color components of the file background color in the order Red, Green, Blue. Where (0x00, 0x00, 0x00)=black; (0xFF, 0xFF, 0xFF)=white.	3	Unsigned Binary Integer	0x00 0x00 0x00	N/A	R
ONAME	**Originator's Name**. This field shall contain a valid name for the operator who originated the file. If the field is all ECS spaces (0x20), then it shall represent that no operator is assigned responsibility for origination.	24	ECS-A	Default is all spaces (0x20) Implementers are encouraged to populate this field with an operationally meaningful value (e.g. an organization or production center name if no operator name is available).	N/A	<R>
OPHONE	**Originator's Phone Number**. This field shall contain a valid phone number for the operator who originated the file. If this field is all ECS spaces (0x20), then it shall represent that no phone number is available for the operator assigned responsibility for origination.	18	ECS-A	Default is all spaces (0x20) Implementers are encouraged to populate this field with an operationally meaningful value (e.g. a production center or help desk number if no operator-specific number is available).	N/A	<R>
FL	**File Length**. This field shall contain the length in bytes of the entire file including all headers, subheaders, and data. Note: The largest file is limited to 999999999998 (10^{12}-2) bytes. A value of 999999999999 in this field indicates that the actual file length was not available when the header was created (paragraph 5.2.1 of MIL-STD-2500C).	12	BCS-N	000000000388 to 999999999998 Note: For file with one Image Segment and one DES, minimum size is 1058.	Bytes	R

NITF2.1 Header Fields for LiDAR Products.						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
HL	**NITF File Header Length**. This field shall contain a valid length in bytes of the NITF file header.	6	BCS-N	000388 to 999998	Bytes	R
NUMI	**Number of Image Segments**. This field shall contain the number of separate image segments included in the file. This field shall be BCS zeros (0x30) if no image segments are included in the file.	3	BCS-N	001 to 999	N/A	R
Start of Number of Image Segments Loop; If NUMI ≠ 000, then Loop runs from 1 to NUMI.						
LISHn	**Length of nth Image Subheader**. This field shall contain a valid length in bytes for the nth image subheader, where n is the number of the IS counting from the first IS (n=001) in order of the image segment's appearance in the file. Possible values for n are 001 to 999. This field shall occur as many times as specified in the NUMI field. This field is conditional and shall be omitted if the NUMI field contains BCS zeros (0x30). Note: The largest image subheader is limited to 999998 (10^{16}-2) bytes. A value of 999999 in this field indicates that the actual subheader length was not available when the header was created (paragraph 5.2.1 of MIL-STD-2500C).	6	BCS-N	000439 to 999998	Bytes	C
LIn	**Length of nth Image Segment**. This field shall contain a valid length in bytes of the nth IS, where n is the number of the IS counting from the first IS (n=001) in order of the IS appearance in the file. Possible values for n are 001 to 999. If the IS is compressed, the length after compression shall be used. This field shall occur many times as specified in the NUMI field. This field is conditional and shall be omitted if the NUMI field contains BCS zeros (0x30). Note: The largest image is limited to 9999999998 (10^{10}-2) bytes. A value of 9999999999 in this field indicates that the actual image length was not available when the header was created (paragraph 5.2.1 of MIL-STD-2500C).	10	BCS-N	0000000001 to 9999999998	Bytes	C
End of Number of Image Segments Loop.						
NUMS	**Number of Graphic Segments**. This field shall contain the number of separate graphic segments included in the file. This field shall be BCS zeros (0x30) if no graphic segments are included in the file.	3	BCS-N	000 to 999	N/A	R
NUMX	**Reserved for Future Use**. This field is reserved for future use and shall be filled with BCS zeros (0x30).	3	BCS-N	000	N/A	R

NITF2.1 Header Fields for LiDAR Products.						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
NUMT	**Number of Text Segments**. This field shall contain the number of separate text segment(s) included in the file. This field shall be BCS zeros (0x30) if no text segments are included in the file.	3	BCS-N	000 to 999	N/A	R
NUMDES	**Number of Data Extension Segments**. This field shall contain the number of separate DES included in the file. This field shall be BCS zeros (0x30) if no DES are included in the file.	3	BCS-N	001 to 999	N/A	R
Start of Number of Data Extension Segments Loop; If NUMDES ≠ 000, then Loop runs from 1 to NUMDES.						
LDSHn	**Length of n^{th} Data Extension Segment Subheader**. This field shall contain a valid length in bytes for the n^{th} DES subheader, where n is the number of the DES counting from the first DES (n=001) in order of the DES's appearance in the file. Possible values for n are 001 to 999. This field shall occur as many times as are specified in the NUMDES field. This field is conditional and shall be omitted if the NUMDES field contains BCS zeros (0x30). Note: The largest subheader is limited to 9998 (10^4-2) bytes. A value of 9999 in this field indicates that the actual subheader length was not available when the header was created (paragraph 5.2.1 of MIL-STD-2500C).	4	BCS-N	0200 to 9998	Bytes	C
LDn	**Length of n^{th} Data Extension Segment**. This field shall contain a valid length in bytes of the data in the n^{th} DES, where n is the number of the DES counting from the first DES (n=001) in order of the DES's appearance in the file. This field shall occur as many times as are specified in the NUMDES field. This field is conditional and shall be omitted if the NUMDES field contains BCS zeros (0x30). Note: The largest DES is limited to 999999998 (10^9-2) bytes. A value of 999999999 in this field indicates that the actual DES length was not available when the header was created (paragraph 5.2.1 of MIL-STD-2500C).	9	BCS-N	000000001 to 999999998	Bytes	C
End of Number of Data Extension Segments Loop.						
NUMRES	**Number of Reserved Extension Segments**. This field shall contain the number of separate RES included in the file. This field shall be BCS zeros (0x30) if no RES are included in the file.	3	BCS-N	000 to 999	N/A	R

NITF2.1 Header Fields for LiDAR Products.						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
UDHDL	**User Defined Header Data Length**. A value of BCS zeros (0x30) shall represent that no TRE are included in the UDHD. If a TRE exists, the field shall contain the sum of the length of all the TRE (paragraph 5.8.1 of MIL-STD-2500C) appearing in the UDHD field plus 3 bytes (length of UDHOFL field). If a TRE is too long to fit in the UDHD field, it shall be put in the TRE overflow DES with DESID set to the value TRE_OVERFLOW (paragraph 5.8.3.1 in MIL-STD-2500C).	5	BCS-N	00000 (for most cases)	Bytes	R
If UDHDL = 00000, then the following fields are omitted.						
UDHOFL	**User Defined Header Overflow**. This field shall contain BCS zeros (0x30) if the TRE in UDHD do not overflow into a DES, or shall contain the sequence number of the DES into which they do overflow. This field shall be omitted if the field UDHDL contains BCS zeros (0x30).	3	BCS-N	Omit (if UDHDL is all BCS zeros (0x30))	Bytes	C
UDHD	**User-Defined Header Data**. If present, this field shall contain user-defined TRE data (paragraph 5.8.1 of MIL-STD-2500C). The length of this field shall be the value contained by the UDHDL field minus 3 bytes. Tagged record extensions shall appear one after the other with no intervening bytes. The first byte of this field shall be the first byte of the first tagged record extension appearing in the field. The last byte of this field shall be the last byte of the last tagged record extension to appear in the field. This field shall be omitted if the UDHDL field contains BCS zeros (0x30).	†	User-Defined	Omit (if UDHDL is all BCS zeros (0x30) or if UDHDL is 00003)	N/A	C
End of UDHDL conditional.						
XHDL	**Extended Header Data Length**. A value of BCS zeros (0x30) shall represent that no TRE are included in the XHD. If a TRE exists, the field shall contain the sum of the length of all the TRE (paragraph 5.8.1 of MIL-STD-2500C) appearing in the XHD field plus 3 bytes (length of XHDLOFL field). If a TRE is too long to fit in the XHD field or the UDHD field, it shall be put in the TRE overflow DES with DESID set to the value TRE_OVERFLOW (paragraph 5.8.3.1 in MIL-STD-2500C).	5	BCS-N	00000, 00003 to 99999	Bytes	R
If XHDL = 00000, then the following fields are omitted.						

NITF2.1 Header Fields for LiDAR Products.						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
XHDLOFL	**Extended Header Data Overflow**. This field shall contain BCS zeros (0x30) if the TRE in XHD do not overflow into a DES, or shall contain the sequence number of the DES into which they do overflow. This field shall be omitted if the field XHDL contains BCS zeros (0x30).	3	BCS-N	000 to 999 Omit (if XHDL is all BCS zeros (0x30))	Bytes	C
XHD	**Extended Header Data**. If present, this field shall contain TRE (paragraph 5.8.1 of MIL-STD-2500C) approved and under configuration management of the ISMC. The length of this field shall be the length specified by the field XHDL minus 3 bytes. TRE shall appear one after the other with no intervening bytes. The first byte of this field shall be the first byte of the first TRE appearing in the field. The last byte of this field shall be the last byte of the last TRE to appear in the field. This field shall be omitted if the XHDL field contains BCS zeros (0x30).	††	Various	TREs Omit (if XHDL is all BCS zeros (0x30) or if XHDL is 00003)	N/A	C
End of XHDL conditional.						

† A value as specified in the UDHDL field minus 3 (in bytes)
†† A value as specified in the XHDL field minus 3 (in bytes)

3.2.3 LiDAR Product NITF2.1 Intensity Image Segment Subheader Description

This NITF2.1 profile for LiDAR products requires a compliant NITFS Image Segment Subheader as defined in MIL-STD-2500C. Table 3.2.3-1 provides the specific implementation of a NITF2.1 Image Segment Subheader for use with LiDAR Intensity Image datasets.

The Intensity product is optional, but either this product or an Elevation Data product (see section 3.2.4) must be provided. The Intensity product must contain regularly-gridded intensity data derived from the associated LiDAR point cloud dataset.

For additional information refer to *MIL-STD-2500C, DoD Interface Standard National Imagery Transmission Format Version 2.1 for the National Imagery Transmission Format Standard.*

Table 3.2.3-1: NITF2.1 Intensity Image Segment Subheader Fields for LiDAR Products.

NITF2.1 Intensity Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
IM	**File Part Type**. This field shall contain the characters "IM" to identify the subheader as an image subheader.	2	BCS-A	IM	N/A	R
IID1	**Image Identifier 1**. This field shall contain a valid alphanumeric identification code associated with the image. The valid codes are determined by the application.	10	BCS-A	INTENSITY	N/A	R
IDATIM	**Image Date and Time**. This field shall contain the time (UTC) of the image acquisition in the format CCYYMMDDhhmmss, where CC is the century (00 to 99), YY is the last two digits of the year (00 to 99), MM is the month (01 to 12), DD is the day (01 to 31), hh is the hour (00 to 23), mm is the minute (00 to 59), and ss is the second (00 to 59). UTC (Zulu) is assumed to be the time zone designator to express time of day. Refer to Paragraph 5.1.7d of MIL-STD-2500C when a portion of the date and/or time is unknown.	14	BCS-N	CCYYMMDDhhmmss	UTC	R
TGTID	**Target Identifier**. This field shall contain the identification of the primary target in the format, BBBBBBBBBBOOOOOCC, consisting of ten characters of Basic Encyclopedia (BE) identifier, followed by five characters of facility OSUFFIX, followed by the two character country code as specified in FIPS PUB 10-4.	17	BCS-A	BBBBBBBBBBOOOOOCC Implementers are encouraged to at least populate the CC subfield when possible. Default is all spaces (0x20) (for all or any sub-part of this field)	N/A	<R>
IID2	**Image Identifier 2**. This field can contain the identification of additional information about the image. This field shall contain the Tactical Image ID for the LiDAR sensor as given in Table 2-1 above.	80	ECS-A	Tactical ID (see Table 2-1) Default is all spaces (0x20)	N/A	R
ISCLAS Through ISCTLN	**For Security Fields ISCLAS through ISCTLN refer to Section 3.2.1 for details.**	167	ECS-A	See paragraph 3.2.1 and Table 3.2.1-1.	N/A	R

NITF2.1 Intensity Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
ENCRYP	**Encryption**. This field shall contain the value BCS zero (0x30) until such time as the MIL-STD-2500C specification is updated to define the use of other values.	1	BCS-N	0 (for not encrypted) Default is a zero (0x30)	N/A	R
ISORCE	**Image Source**. This field shall contain a description of the source of the image. If the source of the data is classified, then the description shall be preceded by the classification, including codeword(s) contained in Table A-4 of MIL-STD-2500C. If this field is all ECS spaces (0x20), then it shall imply that no image source data applies.	42	ECS-A	Implementers are encouraged to populate this field with an operationally meaningful value. E.g. populate with mission name, sensor name, organization name, operation name, or similar means to identify the source of the image. Default is all spaces (0x20)	N/A	<R>
NROWS	**Number of Significant Rows in Image**. This field shall contain the total number of rows of significant pixels in the image. When the product of the values of the NPPBV field and the NBPC field is greater than the value of the NROWS field (NPPBV*NBPC > NROWS), then the rows indexed with the value of the NROWS field to (NPPBV*NBPC) minus 1 shall contain fill data. NOTE: Only the rows indexed 0 to the value of the NROWS field minus 1 of the image contain significant data. The pixel fill values are determined by the application.	8	BCS-N	00000001 to 99999999	pixels	R
NCOLS	**Number of Significant Columns in Image**. This field shall contain the total number of columns of significant pixels in the image. When the product of the values of the NPPBH field and the NBPR field is greater than the value of the NCOLS field (NPPBH*NBPR > NCOLS), then the columns indexed with the value of the NCOLS field to (NPPBH*NBPR) minus 1 shall contain fill data. NOTE: Only the columns indexed 0 to the value of the NCOLS field minus 1 of the image contain significant data. The pixel fill values are determined by the application.	8	BCS-N	00000001 to 99999999	pixels	R

NITF2.1 Intensity Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
PVTYPE	**Pixel Value Type**. This field shall contain an indicator of the type of computer representation used for the value for each pixel for each band in the image. Valid entries are INT for integer, B for bi-level, SI for 2's complement signed integer, R for real, and C for complex. The data bits of INT and SI values shall appear in the file in order of significance, beginning with the MSB and ending with the LSB. Except when the data is JPEG 2000 compressed, INT and SI data types shall be limited to 8, 12, 16, 32, or 64-bits (see field NBPP). R values shall be represented according to IEEE 32 or 64-bit floating point representation (IEEE 754). C values shall be represented with the Real and Imaginary parts, each represented in IEEE 32 or 64-bit floating point representation (IEEE 754) and appearing in adjacent four to eight-byte blocks, first Real, then Imaginary. B (bi-level) pixel values shall be represented as single bits with binary value 1 or 0.	3	BCS-A	INT, R	N/A	R
IREP	**Image Representation**. This field shall contain a valid indicator of the processing required in order to display an image. Valid representation indicators are MONO for monochrome, RGB for red, green, and blue true color, RGB/LUT for mapped color, MULTI for multi-band imagery, NODISPLY for an image not intended for display, NVECTOR and POLAR for vectors with Cartesian and polar coordinates respectively, and VPH for SAR video phase history. In addition, compressed imagery can have this field set to YcbCr601 when compressed in the ITU-R Recommendation BT.601-5 color space using JPEG (IC field = C3). This field should be used in conjunction with the IREPBANDn field to interpret the processing required to display each band in the image.	8	BCS-A	MONO when intensity is measured at only one wavelength MULTI for LiDAR systems that measure intensity at multiple wavelengths (NBANDS>1)	N/A	R

NITF2.1 Intensity Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
ICAT	**Image Category**. This field shall contain a valid indicator of the specific category of image, raster, or grid data. The specific category of an IS reveals its intended use or the nature of its collector. Valid categories include VIS for visible imagery, SL for side-looking radar, TI for thermal infrared, FL for forward-looking infrared, RD for radar, EO for electro-optical, OP for optical, HR for high resolution radar, HS for hyper-spectral, CP for color-frame photography, BP for black/white frame photography, SAR for synthetic aperture radar, SARIQ for SAR radio hologram, IR for infrared, MS for multi-spectral, FP for fingerprints, MRI for magnetic resonance imagery, XRAY for x-rays, CAT for CAT scans, VD for video, BARO for barometric pressure, CURRENT for water current, DEPTH for water depth, and WIND for air wind charts. Valid categories for geographic products or geo-reference support data are MAP for raster maps, PAT for color patch, LEG for legends, DTEM for elevation models, MATR for other types of matrix data, and LOCG for location grids. This field should be used in conjunction with the ISUBCATn field to interpret the significance of each band in the image. *See http://jitc.fhu.disa.mil/nitf/tag_reg/imagesubheader/icat.html for register of codes added via the NTB registration process.*	8	BCS-A	IR when intensity is measured at only one infrared wavelength VIS when intensity is measured at only one visible wavelength. MS for LiDAR systems that measure intensity at multiple wavelengths Note: Other ICAT values may be used when appropriate for the collector.	N/A	R
ABPP	**Actual Bits-Per-Pixel Per Band**. This field shall contain the number of "significant bits" for the value in each band of each pixel without compression. Even when the image is compressed, ABPP contains the number of significant bits per pixel that were present in the image before compression. This field shall be less than or equal to Number of Bits Per Pixel (field NBPP). The number of adjacent bits within each NBPP is used to represent the value. These "representation bits" shall be left justified or right justified within the bits of the NBPP field, according to the value in the PJUST field. For example, if 11-bit pixels are stored in 16 bits, this field shall contain 11 and NBPP shall contain 16. The default number of significant bits to be used is the value contained in NBPP.	2	BCS-N	08 to 32	bits	R

NITF2.1 Intensity Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
PJUST	**Pixel Justification**. When ABPP is not equal to NBPP, this field indicates whether the significant bits are left justified (L) or right justified (R). Non-significant bits in each pixel shall contain the binary value 0. Right justification is recommended.	1	BCS-A	R (Default is R)	N/A	R
ICORDS	**Image Coordinate Representation**. This field shall contain a valid code indicating the type of coordinate representation used for providing an approximate location of the image in the Image Geographic Location field (IGEOLO). The valid values for this field are: U = UTM expressed in Military Grid Reference System (MGRS) form, N = UTM/UPS (Northern hemisphere), S = UTM/UPS (Southern hemisphere), G = GEOGRAPHIC, and D = Decimal degrees. (Choice between N and S is based on hemisphere of northernmost point.) The default Geodetic reference system is WGS84 (appendix B, paragraph B.4.12 and Figure B-1 of MIL-STD-2500C). If no coordinate system is identified, then the space (0x20) shall be used.	1	BCS-A	D, or blank space (A blank space is acceptable if coordinate data for IGEOLO is not available at time of image formation) Default is blank space (0x20)	N/A	<R>
If ICORDS = U, G, N, S, or D, then IGEOLO is present.						
IGEOLO	**Image Geographic Location**. This field, when present, shall contain an approximate geographic location that is not intended for analytical purposes (e.g. targeting, mensuration, distance calculation); it is intended to support general user appreciation for the image location (e.g. cataloguing). The representation of the image corner locations is specified in the ICORDS field. The locations of the four corners of the (significant) image data shall be given in image coordinate order: (0,0), (0,MaxCol), (MaxRow,MaxCol), (MaxRow,0). MaxCol and MaxRow shall be determined from the values contained, respectively, in the NCOLS and NROWS fields. (MaxCol = NCOLS-1.) (MaxRow = NROWS-1.) This field shall be omitted if the value of the ICORDS field is a BCS space (0x20). Valid corner locations in geographic coordinates shall be expressed as latitude and longitude. The format ddmmssXdddmmssY represents latitude and longitude. The first half, ddmmssX,	60	BCS-A	In general: Omit (if ICORDS = a blank space (0x20)), ±dd.ddd±ddd.ddd (four times)	deg	C

NITF2.1 Intensity Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
	represents degrees, minutes, and seconds of latitude with X representing North or South (N for North, S for South). The second half, dddmmssY, represents degrees, minutes, and seconds of longitude with Y representing East or West (E for East, W for West). Coordinates shall only be populated in the IGEOLO field to the known precision of the corner coordinates. Non-significant digits of the field shall be replaced with BCS spaces (0x20). An example of the 60 character field with two spaces depicting the absence of arc seconds is ddmm Xdddmm Yddmm Xdddmm Y Yddmm Xdddmm Y Yddmm Xdddmm Y. Decimal degrees are expressed as ±dd.ddd±ddd.ddd (four times) where ±dd.ddd equals latitude (+ represents northern hemisphere, - represents southern hemisphere) and ±ddd.ddd equals longitude (+ represents eastern hemisphere, - represents western hemisphere). Non-significant digits of the field shall be replaced with BCS spaces (0x20). For the UTM coordinate representation, coordinates shall be expressed either in plain UTM coordinates or using MGRS. In either case, UTM coordinates should be in terms of the same zone, to ensure a unified image on the grid. Normally, UTM/MGRS coordinates should be rounded to the nearest 10 meters to match the precision of the geographic coordinates. Plain UTM coordinates use the format zzeeeeeennnnnnn where zz represents the UTM zone number, and eeeeee, nnnnnnn represents Easting and Northing. Hemisphere (N or S) for plain UTM is expressed in the ICORDS field (appendix B, Figure B-1 of MIL-STD-2500C). UTM expressed in MGRS use the format zzBJKeeeeennnnn where zzBJK represents the zone, band, and 100 km square within the zone and eeeee nnnnn represents residuals of Easting and Northing. Note: Provide the value only to the decimal places (precision)					

NITF2.1 Intensity Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
	warranted by the sources and methods used to determine the location. The remaining places will be BCS spaces (0x20). There is no implied accuracy associated with the data in this field. Additional information associated with precise geo-referencing (e.g. accuracy, datums, etc.) are provided in geospatial related extensions if present in the file.					
End of ICORDS conditional.						
NICOM	**Number of Image Comments**. This field shall contain the number of ICOMn fields that follow to be used as free text image comments.	1	BCS-N	0 to 9	N/A	R
Start of Image Comments Loop; If NICOM ≥ 1, then Loop runs from 1 to NICOM.						
ICOMn	**Image Comment n**. The field ICOMn, when present, shall contain free-form ECS text. These comment fields are intended for use as a single comment block and should be used that way. This field shall contain the n^{th} free text image comment, where n is defined as follows: 1≤n≤ the value of the NICOM field. If the image comment is classified, it shall be preceded by the classification, including codeword(s). This field shall be omitted if the value in the NICOM field is 0.	80	ECS-A	Omit (if NICOM = 0 (0x30)),	N/A	C
End of Image Comments Loop.						

NITF2.1 Intensity Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
IC	**Image Compression**. This field shall contain a valid code indicating the form of compression used in representing the image data. Valid values for this field are, C1 to represent bi-level, C3 to represent JPEG, C4 to represent Vector Quantization, C5 to represent lossless JPEG, I1 to represent down-sampled JPEG, and NC to represent the image is not compressed. Also valid are M1, M3, M4, and M5, for compressed images, and NM for uncompressed images indicating an image that contains a block mask and/or pad pixel mask. C6 and M6 are reserved values that will represent a future correlated multi-component compression algorithm. C7 and M7 are reserved values that will represent a future complex SAR compression. C8 and M8 are the values for ISO standard compression JPEG 2000. The format of a mask image is identical to the format of its corresponding non-masked image except for the presence of an Image Data Mask at the beginning of the image data area. The format of the Image Data Mask is described in paragraph 5.4.3.2 and is shown in Table A-3(A) of MIL-STD-2500C. The definitions of the compression schemes associated with codes C1/M1, C3/M3, C4/M4, and C5/M5 are given, respectively, in ITU-T T.4, AMD2, MIL-STD-188-198A, MIL-STD-188-199, and NGA N0106-97. C1 is found in ITU-T T.4 AMD2, C3 is found in MIL-STD-188-198A, C4 is found in MIL-STD-188-199, and C5 and I1 are found in NGA N0106-97. (NOTE: C2 (ARIDPCM) is not valid in NITF2.1.) The definition of the compression scheme associated with codes C8/M8 is found in ISO/IEC 15444-1:2000 (with amendments 1 and 2).	2	BCS-A	NC, NM (if masking is required with rotated scene), C8 (if JPEG 2000 compression is applied to the file), or M8 (Pixel masking with JPEG 2000 compression is currently undefined and should not be used. Block masking is allowed, though not elegant.) Note: If PVTYPE contains "R", JPEG 2000 compression should not be used.	N/A	R
If IC ≠ NC and NM, then IGEOLO is present.						
COMRAT	**Compression Rate Code**. If the IC field contains C1, C3, C4, C5, C8, M1, M3, M4, M5, M8, or I1, then this field shall be present and contain a code indicating the compression rate for the image. If the value in IC is C1 or M1, then the valid codes are 1D, 2DS, and 2DH, where: 1D represents One-dimensional Coding; 2DS represents Two-dimensional Coding Standard Vertical Resolution	4	BCS-A	Omit (for IC=NC or NM) Nxxy (for IC=C8 or M8 and Numerically Lossless compression, where the bit-rate is given as xx.y and the	N/A	C

NITF2.1 Intensity Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
	(K=2); 2DH represents Two-dimensional Coding High Vertical Resolution (K=4). Explanation of these codes can be found in ITU-T T.4, AMD2. If the value in IC is C3, M3, C5, M5, or I1, then the value of the field shall identify the embedded quantization table(s) used by the JPEG compression algorithm. In this case, the format of this field is XX.Y where XX is the image data type, and Y represents the quality level 1 to 5. The image data types are represented by: 00 represents General Purpose, 01 represents VIS, 02 represents IR, 03 represents SAR, and 04 represents Down-sampled (DS) JPEG. Explanation of the optimized tables can be found in MIL-STD-188-198A and NGA N0106-97. The value of Y shall be 0 if customized tables are used. It is optional, but highly recommended, that the value of XX still be used for the image type with customized tables. If the value of IC is C5 or M5, then the value of Y shall be 0. It is optional, but highly recommended, that the value of XX still be used for the image type. If the value in IC is C4 or M4, then this field shall contain a value given in the form n.nn representing the number of bits-per-pixel for the compressed image. Explanation of the compression rate for vector quantization can be found in MIL-STD-188-199. This field is omitted if the value in IC is NC or NM. If the value of IC is C8 or M8, then this field shall contain a value representing the nominal compression rate (numbers of bits-per-pixel-per-band) of the compressed image. See the BIIF Profile for JPEG 2000 (BPJ2K) for guidance in populating this field.			decimal point is implied) Note: Visually Lossless and lossy compression should not be used. Note: For JPEG 2000 compression, the bit-rate stored in COMRAT may not contain the required precision. The J2KLRA TRE and the JPEG 2000 codestream itself should be interrogated to find the true bit-rate values.		
End of IC conditional.						

NITF2.1 Intensity Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
NBANDS	**Number of Bands**. This field shall contain the number of data bands within the specified image. This field and the IREP field are interrelated and independent of the IMODE field. The corresponding values for the IREP and NBANDS fields are NODISPLY, 0 to 9; MONO, 1; RGB, 3; RGB/LUT, 1; YcbCR601, 3; NVECTOR, 0 to 9; POLAR, 2; VPH, 2; MULTI, 0, 2 to 9; and BCS zero (0x30) for multiple band images or matrices with greater than 9 bands.	1	BCS-N	1 when intensity is measured at only one wavelength 0 or 2 to 9 for LiDAR systems that measure intensity at multiple wavelengths	N/A	R
XBANDS	**Number of Multispectral Bands**. When NBANDS contains the value BCS zero (0x30), this field shall contain the number of bands or data points comprising the multiple band image. Otherwise this field shall be omitted if the value of the NBANDS field is 1 to 9.	5	BCS-N	Positive integer 00010 to 99999	N/A	C
Start of Number of Bands Loop; Loop runs from 1 to NBANDS.						
IREPBANDn	**n^{th} Band Representation**. This field shall contain a valid indicator of the processing required to display the n^{th} band of the image with regard to the general image type as recorded in the IREP field. The significance of each band in the image can be derived from the combination of the ICAT, and ISUBCATn fields. Valid values of the IREPBANDn field depend on the value of the IREP field. The following standard values shall apply: 1.) R, G, B respectively for a Red, Green, Blue representation of the band. 2.) LU for a LUT representation of the band (e.g. a three table LUT for RGB and a single table LUT for shades of grey). 3.) M for a monochrome representation of the band. 4.) BCS spaces (0x20) for a band not designated for display, but may be displayed if desired. 5.) Y, Cb, Cr respectively for the Luminance, Chrominance (blue), and Chrominance (red) representation of a YcbCr601 (compressed case only) image. The only valid values when IREP contains MULTI are M, R, G, B, LU, and BCS spaces (0x20):	2	BCS-A	BCS spaces (0x20) M R G B LU Y Cb Cr	N/A	<R>

NITF2.1 Intensity Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
	1.) It is strongly recommended that 3 of the multiple bands have the IREPBANDn fields populated with R, G, and B. When bands marked as LU, R, G, B, and M are present, then the RGB designated bands are the default bands for display. If R, G, B are not present, then the default displayable band is the LU band. If R, G, B, or LU are not present, then the default displayable band is the first M band. When no bands are marked with LU, R, G, B, or M, then the first three bands may be displayed as R, G, and B respectively. For consistency, multi-spectral images cannot have more than one band, each marked as R, G, and B. 2.) IREPBANDn shall be filled with the M value, if the band is to be represented as monochrome. 3.) IREPBANDn shall be filled with the LU value, if the band is to be represented using a LUT. 4.) When IREPBANDn is filled with BCS spaces (0x20), no specific representation is defined for the band, but it may be displayed if desired. Additional values are reserved for specific interpretations and shall be coordinated with the Custodian to regulate their use. The only valid values when IREP contains MONO are M, LU, or BCS spaces (0x20). The only valid values when IREP contains RGB are R, G, and B. The only valid value when IREP contains RGB/LUT is LU. The only valid values when IREP contains YcbCr601 are Y, Cb, and Cr. Note: There may be more than one band that contains M or LU where the default conditions are such that the first M or LU band is the band to be displayed. This is only the default display to be					

NITF2.1 Intensity Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
	presented to the user. Any other band or combination of bands may be displayed by user intervention.					
ISUBCATn	**nth Band Subcategory**. The purpose of this field is to provide the significance of the nth band of the image with regard to the specific category (ICAT field) of the overall image. The use of this field is user-defined except for the following: For Multi-spectral imagery (ICAT = MS), Hyper-spectral imagery (ICAT = HS), and Infrared imagery (ICAT = IR), ISUBCATn contains the wavelength in nanometers. When ICAT contains SAR or SARIQ, ISUBCATn contains: I for the in-phase band; Q for the quadrature components band; M for the magnitude band; P for the phase components; BCS spaces (0x20) for all other cases. When ICAT contains WIND or CURRENT, ISUBCATn contains SPEED for wind or water speed, or DIRECT for wind or water direction. For location grids, the number of bands is strictly equal to 2; consequently, there are only 2 fields, the ISUBCAT1 field and the ISUBCAT2 field. Standard values of these fields of location grids are either, CGX and CGY for the cartographic X (Easting) and Y (Northing) bands or, GGX and GGY with the geographic X representing the longitude band and Y representing the latitude band. Standard values for the matrix (ICAT = MATR) are FACC codes from DIGEST Part 4 – Annex B. Standard values for Digital Terrain Elevation Models (ICAT = DTEM) are units of length from DIGEST Part 3 – 7.	6	BCS-A	Wavelength, in nanometers Default is BCS spaces (0x20)	N/A	<R>

NITF2.1 Intensity Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
IFCn	**nth Band Image Filter Condition**. This field shall contain the value N (to represent None). Other values are reserved for future use.	1	BCS-A	N	N/A	R
IMFLTn	**nth Band Standard Image Filter Code**. This field is reserved for future use. It shall be filled with BCS spaces (0x20).	3	BCS-A	All spaces (0x20)	N/A	<R>
NLUTSn	**Number of LUTS for the nth Image Band**. This field shall contain the number of LUTs associated with the nth band of the image. LUTs are allowed only if the value of the PVTYPE field is INT or B. If the nth band of the image is monochromatic, this field can contain the value 1 or 2. If the value is 2, then the first and second LUTs shall map, respectively, to the most significant byte and the least significant byte of the 16-bit values. Note: If a system cannot support more than 256 different values, then it may use only the values of the first LUT. In this case, the number of entries in the LUT (NELUTn) may exceed 256. If the nth band of the image is color-coded (the value of the IREPBANDn field is LU), then this field shall contain the value 3. The first, second, and third LUTs in this case, shall map the image to the red, green, and blue display bands respectively. The value 4 is reserved for future use.	1	BCS-N	0 Default is zero (0x30)	N/A	R
End of Number of Bands Loop.						
ISYNC	**Image Sync Code**. This field is reserved for future use. This field shall contain BCS zero (0x30).	1	BCS-N	0 (for no sync code)	N/A	R
IMODE	**Image Mode**. This field shall indicate how the image pixels are stored in the NITF file. Valid values are B, P, R, and S. The interpretation of IMODE is dependent on whether the image is JPEG compressed (IC = C3, C5, I1, M3, or M5), VQ compressed (IC = C4 or M4), or uncompressed (IC = NC or NM). a. Uncompressed. The value S indicates band sequential, where all	1	BCS-A	B	N/A	R

NITF2.1 Intensity Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
	blocks for the first band are followed by all blocks for the second band, and so on. Note that, in each block, the pixels of the first line appear first, followed by the pixels of the second line, and so on. The value B indicates band interleaved by block. This implies that within each block, the bands follow one another. Note that, in each block, the pixels of the first line appear first and the pixels of the last line appear last. The value P indicates band interleaved by pixel within each block: such as, for each block, one after the other, the full pixel vector (all band values) appears for every pixel in the block, one pixel after another, the block column index varying faster than the block row index. The value R indicates band interleaved by row. The ordering mechanism for this case stores the pixel values of each band in row sequential order. Within each block, all pixel values of the first row of the first band are followed by pixel values of the first row of the second band continuing until all values of the first row are stored. The remaining rows are stored in a similar fashion until the last row of values has been stored. Each block shall be zero-filled to the next octet boundary when necessary. If the value of the NBANDS field is 1, then the cases B and S coincide. In this case, this field shall contain B. If the number of blocks is 1 (the NBPR field and the NBPC field contain 1), then this field shall contain B for non-interleaved by pixel, and P for interleaved by pixel. The value S is only valid for images with multiple blocks and multiple bands. b. JPEG-compressed. The presence of B, P, or S implies specific ordering of data within the JPEG image data representation. For this case the interpretation of the various values of the IMODE					

NITF2.1 Intensity Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
	field is specified in MIL-STD-188-198A. When IC contains C8, M8, or I1, IMODE contains B. c. Vector Quantization-compressed. VQ-compressed images are normally either RGB with a color look-up table or monochromatic. In either case, the image is single band, and the IMODE field defaults to B. d. Bi-Level-compressed. When the value of the IC field is C1 or M1, then the value of the IMODE field is B.					
NBPR	**Number of Blocks Per Row**. This field shall contain the number of image blocks in a row of blocks (paragraph 5.4.2.2 of MIL-STD-2500C) in the horizontal direction. If the image consists of only a single block, then this field shall contain the value one.	4	BCS-N	0001-9999	N/A	R
NBPC	**Number of Blocks Per Column**. This field shall contain the number of image blocks in a column of blocks (paragraph 5.4.2.2 of MIL-STD-2500C) in the vertical direction. If the image consists of only a single block, then this field shall contain the value one.	4	BCS-N	0001-9999	N/A	R
NPPBH	**Number of Pixels Per Block Horizontal**. This field shall contain the number of pixels horizontally in each block of the image. It shall be the case that the product of the values of the NBPR field and the NPPBH field is greater than or equal to the value of the NCOLS field (NBPR*NPPBH≥NCOLS). When NBPR is "0001", setting the NPPBH value to "0000" designates that the number of pixels horizontally is specified by the value in NCOLS.	4	BCS-N	1024 (Unless NCOLS<1024)	pixels	R
NPPBV	**Number of Pixels Per Block Vertical**. This field shall contain the number of pixels vertically in each block of the image. It shall be the case that the product of the values of the NBPC field and the NPPBV field is greater than or equal to the value of the NROWS field (NBPC*NPPBV≥NROWS). When NBPC is "0001", setting the NPPBV value to "0000" designates that the number of pixels horizontally is specified by the value in NROWS.	4	BCS-N	1024 (Unless NROWS<1024)	pixels	R

NITF2.1 Intensity Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
NBPP	**Number of Bits Per Pixel Per Band**. If IC contains NC, NM, C4, or M4, then this field shall contain the number of storage bits used for the value from each component of a pixel vector. The value in this field always shall be greater than or equal to Actual Bits Per Pixel (ABPP). For example, if 11-bit pixels are stored in 16-bit words, then this field shall contain 16 and ABPP shall contain 11. For example, if 20-bit pixels are stored in 32-bit words, then this field shall contain 32 and ABPP shall contain 20. If IC=C3, M3, C5, M5, or I1, then this field shall contain the value 8 or the value 12. If IC=C1, then this field shall contain the value 1. If IC=C8 or M8, then this field shall contain the number of bits of precision (01-38) used in the JPEG 2000 compression of the data.	2	BCS-N	08, 16, 32	bits/ pixel	R
IDLVL	**Image Display Level**. This field shall contain a valid value that indicates the display level of the image relative to other displayed file components in a composite display. The valid values are 001 to 999. The display level of each displayable segment (image or graphic) within a file shall be unique; that is, each number from 001 to 999 is the display level of, at most, one segment. Display level is discussed in paragraph 5.3.3 of MIL-STD-2500C. The image or graphic segment in the file having the minimum display level shall have attachment level 0 (IALVL=000).	3	BCS-N	001	N/A	R
IALVL	**Image Attachment Level**. This field shall contain a valid value that indicates the attachment level of the image. Valid values for this field are BCS zeros (0x30), and the display level value of any other image or graphic segment in the file. The meaning of attachment level is discussed in paragraph 5.3.4 of MIL-STD-2500C. The image or graphic segment in the file having the minimum display level shall have attachment level 0 (IALVL=000).	3	BCS-N	000	N/A	R

NITF2.1 Intensity Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
ILOC	**Image Location**. The image location is the location of the first pixel of the first line of the image. This field shall contain the image location offset from the ILOC or SLOC value of the segment to which the image is attached or from the origin of the CCS when the image is unattached (IALVL contains 000). A row or column value of 00000 indicates no offset. Positive row and column values indicate offsets down and to the right while negative row and column values indicate offsets up and to the left.	10	BCS-N	0000000000 RRRRRCCCCC where, RRRRR is either –0001 to –9999 or 00000 to 99999 and where, CCCCC is either –0001 to –9999 or 00000 to 99999	N/A	R
IMAG	**Image Magnification**. This field shall contain the magnification (or reduction) factor of the image relative to the original source image. Decimal values are used to indicate magnification, and decimal fraction values indicate reduction. For example, "2.30" indicates that the original image has been magnified by a factor of 2.30, while "0.5" indicates that the original image has been reduced by a factor of 2.0. The default value is 1.0, indicating no magnification or reduction. In addition, the reductions can be represented as reciprocals of any non-negative integer: /2 (for 1/2), /3 (for 1/3), /4 (for 1/4), /5 (for 1/5), through /999 (for 1/999). The values are left justified and BCS spaces (0x20) filled to the right.	4	BCS-A	decimal value, /x, where x = any nonnegative integer ≤ 999 (Default is 1.0 followed by BCS space (0x20))	N/A	R
UDIDL	**User Defined Image Sub-header Data Length**. A value of BCS zeros (0x30) shall denote that no TRE are included in the UDID field. If a TRE exists, then the field shall contain the sum of the length of all the TRE (paragraph 5.8.1 of MIL-STD-2500C) appearing in the UDID field plus 3 bytes (length of UDOFL field). If a TRE is too long to fit in the UDID field or the IXSHD field, then it shall be put in the TRE overflow DES with DESID set to the value TRE_OVERFLOW (paragraph 5.8.3.1 in MIL-STD-2500C).	5	BCS-N	00000 (for most cases) NOTE: TREs, if any, will all be placed in the IXSHD field. TREs may be placed in the UDID field when the IXSHD field size is not sufficient to contain desired TREs.	bytes	R
If UDIDL = 00000, then the following fields are omitted.						

NITF2.1 Intensity Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
UDOFL	**User Defined Image Sub-header Overflow**. If present, this field shall contain BCS zeros (0x30) if the TRE in UDID do not overflow into a DES, or shall contain the sequence number of the DES into which they do overflow. This field shall be omitted if the field UDIDL contains BCS zeros (0x30).	3	BCS-N	Omit (if UDIDL is all BCS zeros (0x30))	bytes	C
UDID	**User-Defined Image Sub-header Data**. If present, this field shall contain user-defined TRE data (paragraph 5.8.1 of MIL-STD-2500C). The length of this field shall be the length specified by the UDIDL field minus 3 bytes. TRE in this field for an image shall contain information pertaining specifically to the image. TRE shall appear one after the other with no intervening bytes. The first byte of this field shall be the first byte of the first TRE appearing in the field. The last byte of this field shall be the last byte of the last TRE to appear in the field. This field shall be omitted if the UDIDL field contains BCS zeros (0x30).	†	User-Defined	Omit (if UDIDL is all BCS zeros (0x30) or if UDIDL is 00003)	N/A	C
End of UDIDL conditional.						
IXSHDL	**Image Extended Subheader Data Length**. A value of BCS zeros (0x30) shall represent that no TRE are included in the IXSHD field. If a TRE exists, the field shall contain the sum of the length of all the TRE (paragraph 5.8.1 of MIL-STD-2500C) appearing in the IXSHD field plus 3 bytes (length of IXSOFL field). If a TRE is too long to fit in the IXSHD field or the UDID field, it shall be put in the TRE overflow DES with DESID set to the value TRE_OVERFLOW (paragraph 5.8.3.1 in MIL-STD-2500C).	5	BCS-N	00000, 00003-99999	bytes	R
If IXSHDL = 00000, then the following fields are omitted.						
IXSOFL	**Image Extended Subheader Overflow**. If present, this field shall contain BCS zeros (0x30) if the TRE in IXSHD do not overflow into a DES, or shall contain the sequence number of the DES into which they do overflow. This field shall be omitted if the field IXSHDL contains BCS zeros (0x30).	3	BCS-N	000 to 999 Omit (if IXSHDL is all BCS zeros (0x30))	bytes	C

NITF2.1 Intensity Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
IXSHD	**Image Extended Subheader Data**. If present, this field shall contain TRE (para. 5.8.1 of MIL-STD-2500C) approved and under configuration management of the ISMC. The length of this field shall be the length given by IXSHDL minus 3 bytes. For images, TRE in this field shall contain information pertaining specifically to the image. TRE shall appear one after the other with no inter-vening bytes. The first byte of this field shall be the first byte of the first TRE appearing in the field. The last byte of this field shall be the last byte of the last TRE to appear in the field. This field shall be omitted if the IXSHDL field contains BCS zeros (0x30).	††	Various	TREs Omit (if IXSHDL is all BCS zeros (0x30) or if IXSHDL is 00003)	N/A	C
End of IXSHDL conditional.						

† A value as specified in the UDIDL field minus 3 (in bytes)
†† A value as specified in the IXSHDL field minus 3 (in bytes)

3.2.4 LiDAR Product NITF2.1 Elevation Image Segment Subheader Description

This NITF2.1 profile for LiDAR products requires a compliant NITFS Image Segment Subheader as defined in MIL-STD-2500C. Table 3.2.4-1 provides the specific implementation of a NITF2.1 Image Segment Subheader for use with LiDAR datasets.

The Elevation product is optional, but either this product or an Intensity product (see section 3.2.3) must be provided. The Elevation product must contain regularly-gridded elevation data derived from the associated LiDAR point cloud dataset.

For additional information refer to *MIL-STD-2500C, DoD Interface Standard National Imagery Transmission Format Version 2.1 for the National Imagery Transmission Format Standard.*

Table 3.2.4-1: NITF2.1 Elevation Image Segment Subheader Fields for LiDAR Products.

NITF2.1 Elevation Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
IM	**File Part Type**. This field shall contain the characters "IM" to identify the subheader as an image subheader.	2	BCS-A	IM	N/A	R
IID1	**Image Identifier 1**. This field shall contain a valid alphanumeric identification code associated with the image. The valid codes are determined by the application.	10	BCS-A	ELEVATION	N/A	R
IDATIM	**Image Date and Time**. This field shall contain the time (UTC) of the image acquisition in the format CCYYMMDDhhmmss, where CC is the century (00 to 99), YY is the last two digits of the year (00 to 99), MM is the month (01 to 12), DD is the day (01 to 31), hh is the hour (00 to 23), mm is the minute (00 to 59), and ss is the second (00 to 59). UTC (Zulu) is assumed to be the time zone designator to express time of day. Refer to Paragraph 5.1.7d of MIL-STD-2500C when a portion of the date and/or time is unknown.	14	BCS-N	CCYYMMDDhhmmss	UTC	R
TGTID	**Target Identifier**. This field shall contain the identification of the primary target in the format, BBBBBBBBBBOOOOOCC, consisting of ten characters of Basic Encyclopedia (BE) identifier, followed by five characters of facility OSUFFIX, followed by the two character country code as specified in FIPS PUB 10-4.	17	BCS-A	BBBBBBBBBBOOOOOCC Implementers are encouraged to at least populate the CC subfield when possible. Default is all spaces (0x20) (for all or any sub-part of this field)	N/A	<R>
IID2	**Image Identifier 2**. This field can contain the identification of additional information about the image. This field shall contain the Tactical Image ID for the LiDAR sensor as given in Table 2-1 above.	80	ECS-A	Tactical ID (see Table 2-1) Default is all spaces (0x20)	N/A	<R>
ISCLAS Through ISCTLN	**For Security Fields ISCLAS through ISCTLN refer to Section 3.2.1 for details.**	167	ECS-A	See paragraph 3.2.1 and Table 3.2.1-1.	N/A	R

NITF2.1 Elevation Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
ENCRYP	**Encryption**. This field shall contain the value BCS zero (0x30) until such time as the MIL-STD-2500C specification is updated to define the use of other values.	1	BCS-N	0 (for not encrypted) Default is a zero (0x30)	N/A	R
ISORCE	**Image Source**. This field shall contain a description of the source of the image. If the source of the data is classified, then the description shall be preceded by the classification, including codeword(s) contained in Table A-4 of MIL-STD-2500C. If this field is all ECS spaces (0x20), then it shall imply that no image source data applies.	42	ECS-A	Implementers are encouraged to populate this field with an operationally meaningful value. E.g. populate with mission name, sensor name, organization name, operation name, or similar means to identify the source of the image. Default is all spaces (0x20)	N/A	<R>
NROWS	**Number of Significant Rows in Image**. This field shall contain the total number of rows of significant pixels in the image. When the product of the values of the NPPBV field and the NBPC field is greater than the value of the NROWS field (NPPBV*NBPC > NROWS), then the rows indexed with the value of the NROWS field to (NPPBV*NBPC) minus 1 shall contain fill data. NOTE: Only the rows indexed 0 to the value of the NROWS field minus 1 of the image contain significant data. The pixel fill values are determined by the application.	8	BCS-N	00000001 to 99999999	pixels	R
NCOLS	**Number of Significant Columns in Image**. This field shall contain the total number of columns of significant pixels in the image. When the product of the values of the NPPBH field and the NBPR field is greater than the value of the NCOLS field (NPPBH*NBPR > NCOLS), then the columns indexed with the value of the NCOLS field to (NPPBH*NBPR) minus 1 shall contain fill data. NOTE: Only the columns indexed 0 to the value of the NCOLS field minus 1 of the image contain significant data. The pixel fill values are determined by the application.	8	BCS-N	00000001 to 99999999	pixels	R

NITF2.1 Elevation Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
PVTYPE	**Pixel Value Type**. This field shall contain an indicator of the type of computer representation used for the value for each pixel for each band in the image. Valid entries are INT for integer, B for bi-level, SI for 2's complement signed integer, R for real, and C for complex. The data bits of INT and SI values shall appear in the file in order of significance, beginning with the MSB and ending with the LSB. Except when the data is JPEG 2000 compressed, INT and SI data types shall be limited to 8, 12, 16, 32, or 64-bits (see field NBPP). R values shall be represented according to IEEE 32 or 64-bit floating point representation (IEEE 754). C values shall be represented with the Real and Imaginary parts, each represented in IEEE 32 or 64-bit floating point representation (IEEE 754) and appearing in adjacent four to eight-byte blocks, first Real, then Imaginary. B (bi-level) pixel values shall be represented as single bits with binary value 1 or 0.	3	BCS-A	INT, R ,SI	N/A	R
IREP	**Image Representation**. This field shall contain a valid indicator of the processing required in order to display an image. Valid representation indicators are MONO for monochrome, RGB for red, green, and blue true color, RGB/LUT for mapped color, MULTI for multi-band imagery, NODISPLY for an image not intended for display, NVECTOR and POLAR for vectors with Cartesian and polar coordinates respectively, and VPH for SAR video phase history. In addition, compressed imagery can have this field set to YcbCr601 when compressed in the ITU-R Recommendation BT.601-5 color space using JPEG (IC field = C3). This field should be used in conjunction with the IREPBANDn field to interpret the processing required to display each band in the image.	8	BCS-A	MONO NOTE: MONO is used to signal display of the elevation data as if it were a single-band image.	N/A	R

NITF2.1 Elevation Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
ICAT	**Image Category**. This field shall contain a valid indicator of the specific category of image, raster, or grid data. The specific category of an IS reveals its intended use or the nature of its collector. Valid categories include VIS for visible imagery, SL for side-looking radar, TI for thermal infrared, FL for forward-looking infrared, RD for radar, EO for electro-optical, OP for optical, HR for high resolution radar, HS for hyper-spectral, CP for color-frame photography, BP for black/white frame photography, SAR for synthetic aperture radar, SARIQ for SAR radio hologram, IR for infrared, MS for multi-spectral, FP for fingerprints, MRI for magnetic resonance imagery, XRAY for x-rays, CAT for CAT scans, VD for video, BARO for barometric pressure, CURRENT for water current, DEPTH for water depth, and WIND for air wind charts. Valid categories for geographic products or geo-reference support data are MAP for raster maps, PAT for color patch, LEG for legends, DTEM for elevation models, MATR for other types of matrix data, and LOCG for location grids. This field should be used in conjunction with the ISUBCATn field to interpret the significance of each band in the image.	8	BCS-A	DTEM	N/A	R
ABPP	**Actual Bits-Per-Pixel Per Band**. This field shall contain the number of "significant bits" for the value in each band of each pixel without compression. Even when the image is compressed, ABPP contains the number of significant bits per pixel that were present in the image before compression. This field shall be less than or equal to Number of Bits Per Pixel (field NBPP). The number of adjacent bits within each NBPP is used to represent the value. These "representation bits" shall be left justified or right justified within the bits of the NBPP field, according to the value in the PJUST field. For example, if 11-bit pixels are stored in 16 bits, this field shall contain 11 and NBPP shall contain 16. The default number of significant bits to be used is the value contained in NBPP.	2	BCS-N	08 to 64	bits	R

NITF2.1 Elevation Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
PJUST	**Pixel Justification**. When ABPP is not equal to NBPP, this field indicates whether the significant bits are left justified (L) or right justified (R). Non-significant bits in each pixel shall contain the binary value 0. Right justification is recommended.	1	BCS-A	R (Default is R)	N/A	R
ICORDS	**Image Coordinate Representation**. This field shall contain a valid code indicating the type of coordinate representation used for providing an approximate location of the image in the Image Geographic Location field (IGEOLO). The valid values for this field are: U = UTM expressed in Military Grid Reference System (MGRS) form, N = UTM/UPS (Northern hemisphere), S = UTM/UPS (Southern hemisphere), G = GEOGRAPHIC, and D = Decimal degrees. (Choice between N and S is based on hemisphere of northernmost point.) The default Geodetic reference system is WGS84 (appendix B, paragraph B.4.12 and Figure B-1 of MIL-STD-2500C). If no coordinate system is identified, then the space (0x20) shall be used.	1	BCS-A	D, or blank space (A blank space is acceptable if coordinate data for IGEOLO is not available at time of image formation) Default is blank space (0x20)	N/A	<R>
If ICORDS = U, G, N, S, or D, then IGEOLO is present.						
IGEOLO	**Image Geographic Location**. This field, when present, shall contain an approximate geographic location that is not intended for analytical purposes (e.g. targeting, mensuration, distance calculation); it is intended to support general user appreciation for the image location (e.g. cataloguing). The representation of the image corner locations is specified in the ICORDS field. The locations of the four corners of the (significant) image data shall be given in image coordinate order: (0,0), (0,MaxCol), (MaxRow,MaxCol), (MaxRow,0). MaxCol and MaxRow shall be determined from the values contained, respectively, in the NCOLS and NROWS fields. (MaxCol = NCOLS-1.) (MaxRow = NROWS-1.) This field shall be omitted if the value of the ICORDS field is a BCS space (0x20). Valid corner locations in geographic coordinates shall be expressed as latitude and longitude. The format ddmmssXdddmmssY represents latitude and longitude. The first half, ddmmssX,	60	BCS-A	In general: Omit (if ICORDS = a blank space (0x20)), ±dd.ddd±ddd.ddd (four times)	deg	C

NITF2.1 Elevation Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
	represents degrees, minutes, and seconds of latitude with X representing North or South (N for North, S for South). The second half, dddmmssY, represents degrees, minutes, and seconds of longitude with Y representing East or West (E for East, W for West). Coordinates shall only be populated in the IGEOLO field to the known precision of the corner coordinates. Non-significant digits of the field shall be replaced with BCS spaces (0x20). An example of the 60 character field with two spaces depicting the absence of arc seconds is ddmm Xdddmm Yddmm Xdddmm Y Yddmm Xdddmm Y Yddmm Xdddmm Y. Decimal degrees are expressed as ±dd.ddd±ddd.ddd (four times) where ±dd.ddd equals latitude (+ represents northern hemisphere, - represents southern hemisphere) and ±ddd.ddd equals longitude (+ represents eastern hemisphere, - represents western hemisphere). Non-significant digits of the field shall be replaced with BCS spaces (0x20). For the UTM coordinate representation, coordinates shall be expressed either in plain UTM coordinates or using MGRS. In either case, UTM coordinates should be in terms of the same zone, to ensure a unified image on the grid. Normally, UTM/MGRS coordinates should be rounded to the nearest 10 meters to match the precision of the geographic coordinates. Plain UTM coordinates use the format zzeeeeeennnnnnn where zz represents the UTM zone number, and eeeeee, nnnnnnn represents Easting and Northing. Hemisphere (N or S) for plain UTM is expressed in the ICORDS field (appendix B, Figure B-1 of MIL-STD-2500C). UTM expressed in MGRS use the format zzBJKeeeeennnnn where zzBJK represents the zone, band, and 100 km square within the zone and eeeee nnnnn represents residuals of Easting and Northing. Note: Provide the value only to the decimal places (precision)					

NITF2.1 Elevation Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
	warranted by the sources and methods used to determine the location. The remaining places will be BCS spaces (0x20). There is no implied accuracy associated with the data in this field. Additional information associated with precise geo-referencing (e.g. accuracy, datums, etc.) are provided in geospatial related extensions if present in the file.					
End of ICORDS conditional.						
NICOM	**Number of Image Comments**. This field shall contain the number of ICOMn fields that follow to be used as free text image comments.	1	BCS-N	0 to 9	N/A	R
Start of Image Comments Loop; If NICOM ≥ 1, then Loop runs from 1 to NICOM.						
ICOM1	**Image Comment n**. The field ICOMn, when present, shall contain free-form ECS text. These comment fields are intended for use as a single comment block and should be used that way. This field shall contain the n^{th} free text image comment, where n is defined as follows: 1≤n≤ the value of the NICOM field. If the image comment is classified, it shall be preceded by the classification, including codeword(s). This field shall be omitted if the value in the NICOM field is 0.	80	ECS-A	Omit (if NICOM = 0 (0x30)),	N/A	C
End of Image Comments Loop.						

NITF2.1 Elevation Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
IC	**Image Compression**. This field shall contain a valid code indicating the form of compression used in representing the image data. Valid values for this field are, C1 to represent bi-level, C3 to represent JPEG, C4 to represent Vector Quantization, C5 to represent lossless JPEG, I1 to represent down-sampled JPEG, and NC to represent the image is not compressed. Also valid are M1, M3, M4, and M5, for compressed images, and NM for uncompressed images indicating an image that contains a block mask and/or pad pixel mask. C6 and M6 are reserved values that will represent a future correlated multi-component compression algorithm. C7 and M7 are reserved values that will represent a future complex SAR compression. C8 and M8 are the values for ISO standard compression JPEG 2000. The format of a mask image is identical to the format of its corresponding non-masked image except for the presence of an Image Data Mask at the beginning of the image data area. The format of the Image Data Mask is described in paragraph 5.4.3.2 and is shown in Table A-3(A) of MIL-STD-2500C. The definitions of the compression schemes associated with codes C1/M1, C3/M3, C4/M4, and C5/M5 are given, respectively, in ITU-T T.4, AMD2, MIL-STD-188-198A, MIL-STD-188-199, and NGA N0106-97. C1 is found in ITU-T T.4 AMD2, C3 is found in MIL-STD-188-198A, C4 is found in MIL-STD-188-199, and C5 and I1 are found in NGA N0106-97. (NOTE: C2 (ARIDPCM) is not valid in NITF2.1.) The definition of the compression scheme associated with codes C8/M8 is found in ISO/IEC 15444-1:2000 (with amendments 1 and 2).	2	BCS-A	NC, NM (if masking is required with rotated scene), C8 (if JPEG 2000 compression is applied to the file), or M8 (Pixel masking with JPEG 2000 compression is currently undefined and should not be used. Block masking is allowed, though not elegant.) Note: If PVTYPE contains "R", JPEG 2000 compression should not be used.	N/A	R
If IC ≠ NC and NM, then IGEOLO is present.						
COMRAT	**Compression Rate Code**. If the IC field contains C1, C3, C4, C5, C8, M1, M3, M4, M5, M8, or I1, then this field shall be present and contain a code indicating the compression rate for the image. If the value in IC is C1 or M1, then the valid codes are 1D, 2DS, and 2DH, where: 1D represents One-dimensional Coding; 2DS	4	BCS-A	Omit (for IC=NC or NM) Nxxy (for IC=C8 or M8 and Numerically Lossless compression, where the bit-rate is given as xx.y and the	N/A	C

NITF2.1 Elevation Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
	represents Two-dimensional Coding Standard Vertical Resolution (K=2); 2DH represents Two-dimensional Coding High Vertical Resolution (K=4). Explanation of these codes can be found in ITU-T T.4, AMD2. If the value in IC is C3, M3, C5, M5, or I1, then the value of the field shall identify the embedded quantization table(s) used by the JPEG compression algorithm. In this case, the format of this field is XX.Y where XX is the image data type, and Y represents the quality level 1 to 5. The image data types are represented by: 00 represents General Purpose, 01 represents VIS, 02 represents IR, 03 represents SAR, and 04 represents Down-sampled (DS) JPEG. Explanation of the optimized tables can be found in MIL-STD-188-198A and NGA N0106-97. The value of Y shall be 0 if customized tables are used. It is optional, but highly recommended, that the value of XX still be used for the image type with customized tables. If the value of IC is C5 or M5, then the value of Y shall be 0. It is optional, but highly recommended, that the value of XX still be used for the image type. If the value in IC is C4 or M4, then this field shall contain a value given in the form n.nn representing the number of bits-per-pixel for the compressed image. Explanation of the compression rate for vector quantization can be found in MIL-STD-188-199. This field is omitted if the value in IC is NC or NM. If the value of IC is C8 or M8, then this field shall contain a value representing the nominal compression rate (numbers of bits-per-pixel-per-band) of the compressed image. See the BIIF Profile for JPEG 2000 (BPJ2K) for guidance in populating this field.			decimal point is implied) Note: Visually Lossless and Lossy compression should not be used. Note: For JPEG 2000 compression, the bit-rate stored in COMRAT may not contain the required precision. The J2KLRA TRE and the JPEG 2000 codestream itself should be interrogated to find the true bit-rate values.		
End of IC conditional.						

NITF2.1 Elevation Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
NBANDS	**Number of Bands**. This field shall contain the number of data bands within the specified image. This field and the IREP field are interrelated and independent of the IMODE field. The corresponding values for the IREP and NBANDS fields are NODISPLY, 0 to 9; MONO, 1; RGB, 3; RGB/LUT, 1; YcbCR601, 3; NVECTOR, 0 to 9; POLAR, 2; VPH, 2; MULTI, 0, 2 to 9; and BCS zero (0x30) for multiple band images or matrices with greater than 9 bands.	1	BCS-N	1	N/A	R
XBANDS	**Number of Multispectral Bands**. When NBANDS contains the value BCS zero (0x30), this field shall contain the number of bands or data points comprising the multiple band image. Otherwise this field shall be omitted if the value of the NBANDS field is 1 to 9.	5	BCS-N	Omit	N/A	C
Start of Number of Bands Loop; Loop runs from 1 to NBANDS.						
IREPBANDn	**n^{th} Band Representation**. This field shall contain a valid indicator of the processing required to display the n^{th} band of the image with regard to the general image type as recorded in the IREP field. The significance of each band in the image can be derived from the combination of the ICAT, and ISUBCATn fields. Valid values of the IREPBANDn field depend on the value of the IREP field. The following standard values shall apply: 1.) R, G, B respectively for a Red, Green, Blue representation of the band. 2.) LU for a LUT representation of the band (e.g. a three table LUT for RGB and a single table LUT for shades of grey). 3.) M for a monochrome representation of the band. 4.) BCS spaces (0x20) for a band not designated for display, but may be displayed if desired. 5.) Y, Cb, Cr respectively for the Luminance, Chrominance (blue), and Chrominance (red) representation of a YcbCr601 (compressed case only) image. The only valid values when IREP contains MULTI are M, R, G, B, LU, and BCS spaces (0x20):	2	BCS-A	M, spaces Default is all spaces (0x20)	N/A	<R>

NITF2.1 Elevation Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
	1.) It is strongly recommended that 3 of the multiple bands have the IREPBANDn fields populated with R, G, and B. When bands marked as LU, R, G, B, and M are present, then the RGB designated bands are the default bands for display. If R, G, B are not present, then the default displayable band is the LU band. If R, G, B, or LU are not present, then the default displayable band is the first M band. When no bands are marked with LU, R, G, B, or M, then the first three bands may be displayed as R, G, and B respectively. For consistency, multi-spectral images cannot have more than one band, each marked as R, G, and B. 2.) IREPBANDn shall be filled with the M value, if the band is to be represented as monochrome. 3.) IREPBANDn shall be filled with the LU value, if the band is to be represented using a LUT. 4.) When IREPBANDn is filled with BCS spaces (0x20), no specific representation is defined for the band, but it may be displayed if desired. Additional values are reserved for specific interpretations and shall be coordinated with the Custodian to regulate their use. The only valid values when IREP contains MONO are M, LU, or BCS spaces (0x20). The only valid values when IREP contains RGB are R, G, and B. The only valid value when IREP contains RGB/LUT is LU. The only valid values when IREP contains YcbCr601 are Y, Cb, and Cr. Note: There may be more than one band that contains M or LU where the default conditions are such that the first M or LU band is the band to be displayed. This is only the default display to be					

NITF2.1 Elevation Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
	presented to the user. Any other band or combination of bands may be displayed by user intervention.					
ISUBCATn	**nth Band Subcategory**. The purpose of this field is to provide the significance of the nth band of the image with regard to the specific category (ICAT field) of the overall image. The use of this field is user-defined except for the following: For Multi-spectral imagery (ICAT = MS), Hyper-spectral imagery (ICAT = HS), and Infrared imagery (ICAT = IR), ISUBCATn contains the wavelength in nanometers. When ICAT contains SAR or SARIQ, ISUBCATn contains: I for the in-phase band; Q for the quadrature components band; M for the magnitude band; P for the phase components; BCS spaces (0x20) for all other cases. When ICAT contains WIND or CURRENT, ISUBCATn contains SPEED for wind or water speed, or DIRECT for wind or water direction. For location grids, the number of bands is strictly equal to 2; consequently, there are only 2 fields, the ISUBCAT1 field and the ISUBCAT2 field. Standard values of these fields of location grids are either, CGX and CGY for the cartographic X (Easting) and Y (Northing) bands or, GGX and GGY with the geographic X representing the longitude band and Y representing the latitude band. Standard values for the matrix (ICAT = MATR) are FACC codes from DIGEST Part 4 – Annex B. Standard values for Digital Terrain Elevation Models (ICAT = DTEM) are units of length from DIGEST Part 3 – 7.	6	BCS-A	UM, MM, CM, DM, M, KM, IN, FT, YD, FM, FF, MI, or NM Default is all spaces (0x20)	N/A	<R>

NITF2.1 Elevation Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
IFCn	**nth Band Image Filter Condition**. This field shall contain the value N (to represent None). Other values are reserved for future use.	1	BCS-A	N	N/A	R
IMFLTn	**nth Band Standard Image Filter Code**. This field is reserved for future use. It shall be filled with BCS spaces (0x20).	3	BCS-A	All spaces (0x20)	N/A	<R>
NLUTSn	**Number of LUTS for the nth Image Band**. This field shall contain the number of LUTs associated with the nth band of the image. LUTs are allowed only if the value of the PVTYPE field is INT or B. If the nth band of the image is monochromatic, this field can contain the value 1 or 2. If the value is 2, then the first and second LUTs shall map, respectively, to the most significant byte and the least significant byte of the 16-bit values. Note: If a system cannot support more than 256 different values, then it may use only the values of the first LUT. In this case, the number of entries in the LUT (NELUTn) may exceed 256. If the nth band of the image is color-coded (the value of the IREPBANDn field is LU), then this field shall contain the value 3. The first, second, and third LUTs in this case, shall map the image to the red, green, and blue display bands respectively. The value 4 is reserved for future use.	1	BCS-N	0 Default is zero (0x30)	N/A	R
End of Number of Bands Loop.						
ISYNC	**Image Sync Code**. This field is reserved for future use. This field shall contain BCS zero (0x30).	1	BCS-N	0 (for no sync code)	N/A	R
IMODE	**Image Mode**. This field shall indicate how the image pixels are stored in the NITF file. Valid values are B, P, R, and S. The interpretation of IMODE is dependent on whether the image is JPEG compressed (IC = C3, C5, I1, M3, or M5), VQ compressed (IC = C4 or M4), or uncompressed (IC = NC or NM). a. Uncompressed. The value S indicates band sequential, where all	1	BCS-A	B	N/A	R

NITF2.1 Elevation Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
	blocks for the first band are followed by all blocks for the second band, and so on. Note that, in each block, the pixels of the first line appear first, followed by the pixels of the second line, and so on. The value B indicates band interleaved by block. This implies that within each block, the bands follow one another. Note that, in each block, the pixels of the first line appear first and the pixels of the last line appear last. The value P indicates band interleaved by pixel within each block: such as, for each block, one after the other, the full pixel vector (all band values) appears for every pixel in the block, one pixel after another, the block column index varying faster than the block row index. The value R indicates band interleaved by row. The ordering mechanism for this case stores the pixel values of each band in row sequential order. Within each block, all pixel values of the first row of the first band are followed by pixel values of the first row of the second band continuing until all values of the first row are stored. The remaining rows are stored in a similar fashion until the last row of values has been stored. Each block shall be zero-filled to the next octet boundary when necessary. If the value of the NBANDS field is 1, then the cases B and S coincide. In this case, this field shall contain B. If the number of blocks is 1 (the NBPR field and the NBPC field contain 1), then this field shall contain B for non-interleaved by pixel, and P for interleaved by pixel. The value S is only valid for images with multiple blocks and multiple bands. b. JPEG-compressed. The presence of B, P, or S implies specific ordering of data within the JPEG image data representation. For this case the interpretation of the various values of the IMODE					

NITF2.1 Elevation Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
	field is specified in MIL-STD-188-198A. When IC contains C8, M8, or I1, IMODE contains B. c. Vector Quantization-compressed. VQ-compressed images are normally either RGB with a color look-up table or monochromatic. In either case, the image is single band, and the IMODE field defaults to B. d. Bi-Level-compressed. When the value of the IC field is C1 or M1, then the value of the IMODE field is B.					
NBPR	**Number of Blocks Per Row**. This field shall contain the number of image blocks in a row of blocks (paragraph 5.4.2.2 of MIL-STD-2500C) in the horizontal direction. If the image consists of only a single block, then this field shall contain the value one.	4	BCS-N	0001-9999	N/A	R
NBPC	**Number of Blocks Per Column**. This field shall contain the number of image blocks in a column of blocks (paragraph 5.4.2.2 of MIL-STD-2500C) in the vertical direction. If the image consists of only a single block, then this field shall contain the value one.	4	BCS-N	0001-9999	N/A	R
NPPBH	**Number of Pixels Per Block Horizontal**. This field shall contain the number of pixels horizontally in each block of the image. It shall be the case that the product of the values of the NBPR field and the NPPBH field is greater than or equal to the value of the NCOLS field (NBPR*NPPBH≥NCOLS). When NBPR is "0001", setting the NPPBH value to "0000" designates that the number of pixels horizontally is specified by the value in NCOLS.	4	BCS-N	1024	pixels	R
NPPBV	**Number of Pixels Per Block Vertical**. This field shall contain the number of pixels vertically in each block of the image. It shall be the case that the product of the values of the NBPC field and the NPPBV field is greater than or equal to the value of the NROWS field (NBPC*NPPBV≥NROWS). When NBPC is "0001", setting the NPPBV value to "0000" designates that the number of pixels horizontally is specified by the value in NROWS.	4	BCS-N	1024	pixels	R

NITF2.1 Elevation Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
NBPP	**Number of Bits Per Pixel Per Band**. If IC contains NC, NM, C4, or M4, then this field shall contain the number of storage bits used for the value from each component of a pixel vector. The value in this field always shall be greater than or equal to Actual Bits Per Pixel (ABPP). For example, if 11-bit pixels are stored in 16-bit words, then this field shall contain 16 and ABPP shall contain 11. If IC=C3, M3, C5, M5, or I1, then this field shall contain the value 8 or the value 12. If IC=C1, then this field shall contain the value 1. If IC=C8 or M8, then this field shall contain the number of bits of precision (01-38) used in the JPEG 2000 compression of the data.	2	BCS-N	08, 16, 32, 64	bits/ pixel	R
IDLVL	**Image Display Level**. This field shall contain a valid value that indicates the display level of the image relative to other displayed file components in a composite display. The valid values are 001 to 999. The display level of each displayable segment (image or graphic) within a file shall be unique; that is, each number from 001 to 999 is the display level of, at most, one segment. Display level is discussed in paragraph 5.3.3 of MIL-STD-2500C. The image or graphic segment in the file having the minimum display level shall have attachment level 0 (IALVL=000).	3	BCS-N	001 if Intensity Image product is not present, 002 otherwise.	N/A	R
IALVL	**Image Attachment Level**. This field shall contain a valid value that indicates the attachment level of the image. Valid values for this field are BCS zeros (0x30), and the display level value of any other image or graphic segment in the file. The meaning of attachment level is discussed in paragraph 5.3.4 of MIL-STD-2500C. The image or graphic segment in the file having the minimum display level shall have attachment level 0 (IALVL=000).	3	BCS-N	000	N/A	R

NITF2.1 Elevation Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
ILOC	**Image Location**. The image location is the location of the first pixel of the first line of the image. This field shall contain the image location offset from the ILOC or SLOC value of the segment to which the image is attached or from the origin of the CCS when the image is unattached (IALVL contains 000). A row or column value of 00000 indicates no offset. Positive row and column values indicate offsets down and to the right while negative row and column values indicate offsets up and to the left.	10	BCS-N	0000000000 RRRRRCCCCC where, RRRRR is either –0001 to –9999 or 00000 to 99999 and where, CCCCC is either –0001 to –9999 or 00000 to 99999	N/A	R
IMAG	**Image Magnification**. This field shall contain the magnification (or reduction) factor of the image relative to the original source image. Decimal values are used to indicate magnification, and decimal fraction values indicate reduction. For example, "2.30" indicates that the original image has been magnified by a factor of 2.30, while "0.5" indicates that the original image has been reduced by a factor of 2.0. The default value is 1.0, indicating no magnification or reduction. In addition, the reductions can be represented as reciprocals of any non-negative integer: /2 (for 1/2), /3 (for 1/3), /4 (for 1/4), /5 (for 1/5), through /999 (for 1/999). The values are left justified and BCS spaces (0x20) filled to the right.	4	BCS-A	1.0 followed by a BCS space (0x20) Default is 1.0 followed by a BCS space (0x20)	N/A	R
UDIDL	**User Defined Image Sub-header Data Length**. A value of BCS zeros (0x30) shall denote that no TRE are included in the UDID field. If a TRE exists, then the field shall contain the sum of the length of all the TRE (paragraph 5.8.1 of MIL-STD-2500C) appearing in the UDID field plus 3 bytes (length of UDOFL field). If a TRE is too long to fit in the UDID field or the IXSHD field, then it shall be put in the TRE overflow DES with DESID set to the value TRE_OVERFLOW (paragraph 5.8.3.1 in MIL-STD-2500C).	5	BCS-N	00000 (for most cases) NOTE: TREs, if any, will all be placed in the IXSHD field. TREs may be placed in the UDID field when the IXSHD field size is not sufficient to contain desired TREs.	bytes	R
If UDIDL = 00000, then the following fields are omitted.						

NITF2.1 Elevation Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
UDOFL	**User Defined Image Sub-header Overflow**. If present, this field shall contain BCS zeros (0x30) if the TRE in UDID do not overflow into a DES, or shall contain the sequence number of the DES into which they do overflow. This field shall be omitted if the field UDIDL contains BCS zeros (0x30).	3	BCS-N	Omit (if UDIDL is all BCS zeros (0x30))	bytes	C
UDID	**User-Defined Image Sub-header Data**. If present, this field shall contain user-defined TRE data (paragraph 5.8.1 of MIL-STD-2500C). The length of this field shall be the length specified by the UDIDL field minus 3 bytes. TRE in this field for an image shall contain information pertaining specifically to the image. TRE shall appear one after the other with no intervening bytes. The first byte of this field shall be the first byte of the first TRE appearing in the field. The last byte of this field shall be the last byte of the last TRE to appear in the field. This field shall be omitted if the UDIDL field contains BCS zeros (0x30).	†	User-Defined	Omit (if UDIDL is all BCS zeros (0x30) or if UDIDL is 00003)	N/A	C
End of UDIDL conditional.						
IXSHDL	**Image Extended Subheader Data Length**. A value of BCS zeros (0x30) shall represent that no TRE are included in the IXSHD field. If a TRE exists, the field shall contain the sum of the length of all the TRE (paragraph 5.8.1 of MIL-STD-2500C) appearing in the IXSHD field plus 3 bytes (length of IXSOFL field). If a TRE is too long to fit in the IXSHD field or the UDID field, it shall be put in the TRE overflow DES with DESID set to the value TRE_OVERFLOW (paragraph 5.8.3.1 in MIL-STD-2500C).	5	BCS-N	00000, 00003-99999	bytes	R
If IXSHDL = 00000, then the following fields are omitted.						
IXSOFL	**Image Extended Subheader Overflow**. If present, this field shall contain BCS zeros (0x30) if the TRE in IXSHD do not overflow into a DES, or shall contain the sequence number of the DES into which they do overflow. This field shall be omitted if the field IXSHDL contains BCS zeros (0x30).	3	BCS-N	000 to 999 Omit (if IXSHDL is all BCS zeros (0x30))	bytes	C

NITF2.1 Elevation Image Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
IXSHD	**Image Extended Subheader Data**. If present, this field shall contain TRE (para. 5.8.1 of MIL-STD-2500C) approved and under configuration management of the ISMC. The length of this field shall be the length given by IXSHDL minus 3 bytes. For images, TRE in this field shall contain information pertaining specifically to the image. TRE shall appear one after the other with no inter-vening bytes. The first byte of this field shall be the first byte of the first TRE appearing in the field. The last byte of this field shall be the last byte of the last TRE to appear in the field. This field shall be omitted if the IXSHDL field contains BCS zeros (0x30).	††	Various	TREs (see section 4.0 for TREs) Omit (if IXSHDL is all BCS zeros (0x30) or if IXSHDL is 00003)	N/A	C
End of IXSHDL conditional.						

† A value as specified in the UDIDL field minus 3 (in bytes)
†† A value as specified in the IXSHDL field minus 3 (in bytes)

3.2.5 LiDAR Product NITF2.1 LIDARA Data Extension Segment Subheader Description

This NITF2.1 profile for LiDAR requires a compliant NITFS Data Extension Segment Subheader as defined in MIL-STD-2500C. Table 3.2.5-1 provides the specific implementation of a NITF2.1 Data Extension Segment Subheader for use with LiDAR datasets.

The LIDARA Data Extension Segment methodology is designed to store a LiDAR point cloud dataset, in binary LAS format, in its entirety. The inclusion of this DES is optional, but if it is included, it must be accompanied by an Intensity image segment, an Elevation image segment, or both. The point cloud data should be extracted from the NITF2.1 file for use with appropriate LIDAR exploitation tools that support files in LAS format. The data contained within the LAS file must be the source from which the Intensity and Elevation image segments were derived. The Intensity and/or Elevation image segments are provided to give the user the ability to view the area of coverage of the LIDAR point cloud data set. These image segments are not intended for exploitation use but provide a quick look visualization of the area covered by the point cloud dataset.

Storage of the point cloud data is achieved by carrying out a byte-for-byte transfer of the LAS file into the user-defined data portion of the DES. The total amount transferred into the DES cannot exceed 999999998 bytes (hereafter referred to as 1 Gigabyte, or 1 GB, for convenience). For LAS files that are larger than 1 GB, multiple instances of the LIDARA DES can be used. The first instance contains the first 1 GB of the LAS file, the second contains the next 1GB of the LAS file, and so on-until the LAS file is completely transferred. The total number of NITF segment instances cannot exceed 999, which results in the ability to store LAS files up to approximately one Terabyte (1 TB) in size. If multiple instances are required, they should be placed in the NITF file in the order in which they were created. The zero-based INDEX user-defined subheader field is used to specify where each instance falls in the overall DES creation sequence. For example, if four instances are needed to encapsulate a given LAS file, the INDEX values for each one are 0, 1, 2, and 3, respectively.

For additional information refer to *MIL-STD-2500C, DoD Interface Standard National Imagery Transmission Format Version 2.1 for the National Imagery Transmission Format Standard* and *LAS Specification, Versions 1.2 or 1.3*.

Table 3.2.5-1: NITF2.1 LIDARA Data Extension Segment Subheader Fields for LiDAR Products.

NITF2.1 LIDARA Data Extension Segment Subheader Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
DE	**File Part Type**. This field shall contain the characters "DE" to identify the subheader as a data extension.	2	BCS-A	DE	N/A	R
DESID	**Unique DES Type Identifier**. This field shall contain a valid alphanumeric identifier properly registered with the ISMC.	25	BCS-A	LIDARA DES	N/A	R
DESVER	**Version of the Data Definition**. This field shall contain the alphanumeric version number of the use of the tag. The version number is assigned as part of the registration process.	2	BCS-N	01	N/A	R
DECLAS Through DECTLN	**For Security Fields DECLAS through DECTLN refer to Section 3.2.1 for details.**	167	ECS-A	See paragraph 3.2.1 and Table 3.2.1-1.	N/A	R
DESSHL	**DES User-defined Subheader Length**. This field shall contain the number of bytes in the DES User-Defined Subheader Fields.	4	BCS-N	0003	N/A	R
DES User-Defined Subheader Fields.						
INDEX	**DES Position.** This field shall reference the sequential position of the DES with respect to all others created to encapsulate an LAS file. This value is assigned during the encapsulation process.	3	BCS-N	000 to 998 Default is 000	N/A	R
DES User-Defined Data.						
User-defined data shall consist of a byte-for-byte transfer of data from an LAS file, not to exceed a total of 999999998 bytes (approximately one Gigabyte, 1 GB). For larger LAS files, multiple instances of this DES shall be used in concert with the INDEX subheader field to indicate how many instances were required and where each instance falls in the overall DES creation sequence. The first four characters in the first instance of the LIDARA DES user-defined data field shall be the string 'LASF'. Note that while other aspects of the NITF file format use 'big endian' byte sequences, LAS data is recorded using the 'little endian' byte sequence. Consequently, the byte-for-byte transfer of LAS data within the LIDARA DES User-Defined Data field retains the byte sequence of the source LAS file.						

4.0 Product Tagged Record Extension Definitions

The NITF2.1 profiles for LiDAR data products (Intensity and Elevation image segments) may use some or all of the following Tagged Record Extensions (TREs). While the TREs are placed in, and therefore descriptive of, the Intensity and Elevation image segments, a number of the TRE elements are also descriptive of the LiDAR point cloud dataset from which the intensity and elevation data are derived (as designated in the TRE description tables below).

TREs Present in the NITF2.1 File Header or its TRE_OVERFLOW DES

- None

TREs Present in the NITF2.1 Intensity Image Subheader or its TRE_OVERFLOW DES

- ACCPOB – Positional Accuracy
- ACFTB – Aircraft Information
- AIMIDB – Additional Image ID
- CSCRNA – Corner Footprint
- GEOLOB – Local Geographic Coordinate System
- GEOPSB – Geo Positioning Information
- HISTOA – Image Processing History
- MSTGTA – Mission Target Identification
- PIATGB – Profile for Imagery Target Support
- J2KLRA – JPEG 2000 (J2K) Layer Target Bit-Rates

TREs Present in the NITF2.1 Elevation Data Subheader or its TRE_OVERFLOW DES

- ACCPOB – Positional Accuracy
- ACFTB – Aircraft Information
- AIMIDB – Additional Image ID
- CSCRNA – Corner Footprint
- GEOLOB – Local Geographic Coordinate System
- GEOPSB – Geo Positioning Information
- HISTOA – Image Processing History
- MSTGTA – Mission Target Identification
- PIATGB – Profile for Imagery Target Support
- J2KLRA – JPEG 2000 (J2K) Layer Target Bit-Rates

The metadata population conventions discussed in section 3.0 shall be followed in section 4.0 as well.

4.1 Common Tagged Record Extensions

The following Tagged Record Extensions (TREs) may be found in LiDAR datasets. Some of the TREs defined here are required for a given dataset while other TREs are merely optional. Certain TREs, such as the J2KLRA TRE, are required only conditionally, based on the processing applied to the imagery data (e.g. use of JPEG 2000 compression) or collection requirements (e.g. target definitions). TREs that are presented as being optional, as opposed to conditional, may not be present in a given LiDAR dataset; their use is entirely up to the processing element forming the NITF2.1 dataset.

The TREs used in the various LiDAR datasets and their obligation (required, conditional, or optional) is presented in Table 4.1-1.

Table 4.1-1: TRE Usage in LiDAR Products.

TRE Usage in LiDAR Products		
TRE Name	**NITF Location**	**Obligation**
ACCPOB	IXSHD or TRE_OVERFLOW DES	Optional
ACFTB	IXSHD	Required
AIMIDB	IXSHD	Required
CSCRNA	IXSHD or TRE_OVERFLOW DES	Required
GEOLOB	IXSHD or TRE_OVERFLOW DES	Required
GEOPSB	IXSHD or TRE_OVERFLOW DES	Required
HISTOA	IXSHD	Required
MSTGTA	IXSHD or TRE_OVERFLOW DES	Optional
PIATGTB	IXSHD or TRE_OVERFLOW DES	Optional
J2KLRA	IXSHD	Conditional (1)

Obligation Notes

Note 1: J2KLRA is required to be included in all image segment subheaders utilizing JPEG2000 compression.

4.1.1 ACCPOB TRE for LiDAR Products

The Positional Accuracy support data extension (ACCPOB) is contained in the image extended subheader data section of the NITF2.1 Subheader. This tagged record extension may be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Subheader. Table 4.1.1-1 provides the field descriptions and metadata population requirements for ACCPOB TRE used with LiDAR datasets. This TRE is optional for all such datasets. Should ACCPOB TRE be present in an image segment, it shall indicate the positional accuracy of the data in that image segment.

For additional information refer to *STANAG 7074, Digital Geographic Information Exchange Standard (DIGEST), Part 2 Annex D.*

Table 4.1.1-1: ACCPOB TRE Fields for LiDAR Products.

ACCPOB TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	ACCPOB	N/A	R
CEL	**Length of CEDATA**. This field contains the length, in bytes, of the data stored in the TRE, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	00017 to 99985	bytes	R
NUM_ACPO	**Number of Positional Accuracy Regions**. This field shall contain the number of positional accuracy regions to follow. The maximum number of positional accuracy regions is limited to **99**.	2	BCS-N	positive integer **01** to **99**	N/A	R
Repeat for each NUM_ACPO.						
UNIAAHn	**Unit of Measure for AAHn**. This field shall contain the units for AAHn or **BCS Spaces** if the absolute horizontal accuracy is unknown or not applicable.	3	BCS-A	See DIGEST Edition 2.1, Part 3-7	N/A	<R>
AAHn	**Absolute Horizontal Accuracy**. This field is omitted when UNIAAHn contains BCS Spaces. Otherwise, this field shall contain the absolute horizontal accuracy for the nth region of positional accuracy.	5	BCS-N	positive integer **00000** to **99999**	N/A	C
UNIAAVn	**Unit of Measure for AAVn**. This field shall contain the units for AAVn or **BCS Spaces** if the absolute vertical accuracy is unknown or not applicable.	3	BCS-A	See DIGEST Edition 2.1, Part 3-7	N/A	<R>
AAVn	**Absolute Vertical Accuracy**. This field is omitted when UNIAAVn contains BCS Spaces. Otherwise, this field shall contain the absolute vertical accuracy for the nth region of positional accuracy.	5	BCS-N	**00000** to **99999**	N/A	C

ACCPOB TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
UNIAPHn	**Unit of Measure for APHn**. This field shall contain the units for APHn or **BCS Spaces** if the point-to-point horizontal accuracy is unknown or not applicable.	3	BCS-A	See DIGEST Edition 2.1, Part 3-7	N/A	<R>
APHn	**Point-to-Point Horizontal Accuracy**. This field is omitted when UNIAPHn contains BCS Spaces. Otherwise, this field shall contain the point-to-point (relative) horizontal accuracy for the nth region of positional accuracy.	5	BCS-N	**00000** to **99999**	N/A	C
UNIAPVn	**Unit of Measure for APVn**. This field shall contain the units for APVn or **BCS Spaces** if the point-to-point vertical accuracy is unknown or not applicable.	3	BCS-A	See DIGEST Edition 2.1, Part 3-7	N/A	<R>
APVn	**Point-to-Point Vertical Accuracy**. This field is omitted when UNIAPVn contains BCS Spaces. Otherwise, this field shall contain the point-to-point (relative) vertical accuracy for the nth region of positional accuracy.	5	BCS-N	**00000** to **99999**	N/A	C
NUM_PTSn	**Number of Points in Bounding Polygon**. This field defines the number of points (coordinate pairs) that are used to define the bounding polygon of the nth region of positional accuracy. Coordinate values shall refer to the coordinate system and units defined in GEOPS (and possibly in PRJPS). First and last points shall be the same. If the accuracy information applies to the entire Image Segment (the value of NUM_ACPO is 1 and the ACCVT and ACCHZ extensions are not present), then this field does not apply and will contain **000**.	3	BCS-N	positive integer **004** to **999** or **000**	N/A	R
Repeat for each NUM_PTSn.						

ACCPOB TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
LONnm	**Longitude/Easting**. This field shall be omitted when the value of NUM_PTSn is 00. Otherwise, this field shall contain the easting (when the value of GEOPS.UNI is M) or longitude (otherwise) of the mth point.	15	BCS-N	Longitude value	N/A	C
LATnm	**Latitude/Northing**. This field shall be omitted when the value of NUM_PTSn is 00. Otherwise, this field shall contain the northing (when the value of GEOPS.UNI is M) or latitude (otherwise) of the mth point.	15	BCS-N	Latitude value	N/A	C
…..End of Repeat for each NUM_PTSn						
…..End of Repeat for each NUM_ACPO.						

4.1.2 ACFTB TRE for LiDAR Products

The Aircraft Information airborne support data extension (ACFTB) is contained in the image extended subheader data section of the NITF2.1 Subheader. This tagged record extension should not be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Subheader. Table 4.1.2-1 provides the field descriptions and metadata population requirements for ACFTB TRE used with LiDAR datasets.

The ACFTB TRE is shown as required for airborne imagery in STDI-0002 Table 8-1.

The ACFTB TRE records information specific to airborne sensor systems. In general, the data elements describe the aircraft remote sensing mission and associated mission planning information, the identification of the sensor and its mode of operation, location of the aircraft during the sensing operation, and several of the sensor system's static parameters. The Intensity and Elevation data contained in the NITF image segments is derived through a processing event (as recorded in the HISTOA TRE) and has been rectified to an earth coordinate reference system. Likewise, the point cloud data within the LIDARA DES has been processed from the raw sensor returns to derive positions for each point. As used within this profile, the information in ACFTB represents information about the nature of the data collection prior to the processing events from which the point cloud dataset, Intensity image, and elevation data were derived through processing.

For additional information refer to *STDI-0002, The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITFS).*

Table 4.1.2-1: ACFTB TRE Fields for LiDAR Products.

ACFTB TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	ACFTB	N/A	R
CEL	**Length of CEDATA**. This field contains the length, in bytes, of the data stored in the TRE, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	00207	bytes	R
AC_MSN_ID	**Aircraft Mission Identification**. This field contains the name of the mission. If the mission name is not available, then this field shall be populated with the value NOT AVAILABLE followed by 7 BCS spaces.	20	BCS-A	generate Default is NOT AVAILABLE followed by 7 BCS spaces (0x20)	N/A	R
AC_TAIL_NO	**Aircraft Tail Number**. This field records the tail number of the aircraft flying the mission.	10	BCS-A	generate Default is BCS spaces (0x20)	N/A	<R>
AC_TO	**Aircraft Take-Off Date and Time**. This field records the date and time that the aircraft took-off to fly the mission. The date and time are referenced to UTC.	12	BCS-A	CCYYMMDDhhmm where, CC is the century, YY is the year, MM is the month (01-12), DD is the day of the month (01-31), hh is the hour (00-23), and mm is the minute (00-59). Note: Leap seconds are not used in this definition. Default is BCS spaces (0x20)	UTC	<R>
SENSOR_ID_ TYPE	**Sensor Identification Type**. This field identifies which sensor type produced the image. For LiDAR Imagery: ccff where, cc indicates the sensor category: LI (LiDAR)	4	BCS-A	LILN, LIGM See listing of NITF registered field values: http://jitc.fhu.disa.mil/nitf/tag_reg/acftb/acftb.html	N/A	R

ACFTB TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
	And ff indicates the sensor format: LN (Linear Mode) GM (Geiger Mode) Note: The contents of several fields below depend upon the value of this field.					
SENSOR_ID	**Sensor ID**. This field identifies the specific sensor that produced the image. Note: The contents of several fields below depend upon the value of this field.	6	BCS-A	See listing of NITF registered field values: http://jitc.fhu.disa.mil/nitf/tag_reg/acftb/acftb.html	N/A	R
SCENE_SOURCE	**Scene Source**. This field indicates the origin of the request for the current scene. A scene is a single image or a collection of images providing contiguous coverage of an area of interest. 0 = Pre-Planned 1 to 9 are system specific.	1	BCS-A	**0** See listing of NITF registered field values: http://jitc.fhu.disa.mil/nitf/tag_reg/acftb/acftb.html	N/A	R
SCNUM	**Scene Number**. This field identifies the current scene, and is determined from the mission plan; except for immediate scenes, where it may have the value 000000, the scenes are numbered from 000001 to 999999. The scene number is only useful to replay/regenerate a specific scene; there is no relationship between the scene number and an exploitation requirement.	6	BCS-N	000000-999999 (in general)	N/A	R
PDATE	**Processing Date**. For EO and IR systems, this field records the date that the image file was produced. For SAR systems, this field records the date that the raw data was converted to imagery. The date changes at midnight UTC.	8	BCS-N	CCYYMMDD (where CC is the century, YY is the year, MM is the month (01-12), and DD is the day of the month (01-31)).	UTC	R
IMHOSTNO	**Immediate Scene Host**. Together with the Immediate Scene Request ID field below, this field denotes the scene that the immediate scene was initiated from and can be used to renumber the	6	BCS-N	000000, 000001-999999 (in general)	N/A	R

ACFTB TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
	scene. For example, if the immediate scene was initiated from scene number 000123 and this is the third request from that scene, then the scene number field will be 000000, the immediate scene host field will contain 000123 and the immediate scene request ID will contain 000003. Only non-zero for immediate scenes.					
IMREQID	**Immediate Scene Request ID**. This field provides the number of the current immediate scene taken from the original scene number recorded in the Immediate Scene Host field above.	5	BCS-N	00000, 00001-99999 (in general)	N/A	R
MPLAN	**Mission Plan Mode**. This field defines the current sensor-specific SENSOR_TYPE / SENSOR_ID collection mode. For LiDAR: 999 – Mission Plan Mode not specified.	3	BCN-N	**999** See listing of NITF registered field values: http://jitc.fhu.disa.mil/nitf/tag_reg/acftb/acftb.html	N/A	R
Note: Where the image extends along an extended path, as with SAR Search modes and EO-IR Wide Area Search modes, the entry and exit locations are the specified latitude, longitude, and elevation above mean sea level (MSL) of the planned entry and exit points on the centerline of the area contained within the NITF Image Segment. Where the image is confined to the area about a single reference point, as with Spot modes and Point Target modes, the entry fields contain the specified reference point latitude/longitude/elevation, and the exit fields are filled with spaces. The location may be expressed in either degrees-minutes-seconds or in decimal degrees. The format ddmmss.ssssX represents degrees (00 to 89), minutes (00 to 59), seconds (00 to 59), and ten-thousandths of seconds (0000 to 9999) of latitude, with X=N for north and S for south, and dddmmss.ssssY represents degrees (000 to 179), minutes (00 to 59), seconds (00 to 59), and ten-thousandths of seconds (0000 to 9999) of longitude, with Y=E for east or W for west. The format ±dd.dddddddd indicates degrees of latitude (north is positive), and ±ddd.dddddddd represents degrees of longitude (east is positive).						
ENTLOC	**Entry Location**. For imagery extending along an extended path, such as with SAR Search modes or EO-IR Wide Area Search (WAS) modes, this field provides the latitude and longitude of the entry location for the collection of the image scene. For imagery collected around a single reference point, as with Spot or Point Target collection modes, this field provides the latitude and longitude of the specified	25	BCS-A	ddmmss.ssssXdddmmss.ssssY, ±dd.ddddddddd±ddd.ddddddddd or all spaces if not known (in general) Default is BCS spaces (0x20)	degrees	<R>

ACFTB TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
	reference point.					
LOC_ACCY	**Location Accuracy**. This field defines the 90% probable circular error in the ENTLOC and EXITLOC positions. For unknown CE90 values use 000000 or 000.00.	6	BCS-A	000.01-999.99, 000000, or 000.00	feet	R
ENTELV	**Entry Elevation**. This field identifies the imaging operation entry point ground elevation above mean sea level (MSL).	6	BCS-A	-01000 to +30000 Default is BCS spaces (0x20)	feet or meters	<R>
ELV_UNIT	**Unit of Elevation**. This field defines the units of the entry and exit altitudes.	1	BCS-A	f or m Default is a BSC space (0x20)	N/A	<R>
EXITLOC	**Exit Location**. For imagery extending along an extended path, such as with SAR Search modes or EO-IR Wide Area Search (WAS) modes, this field provides the latitude and longitude of the exit location for the collection of the image scene. For imagery collected around a single reference point, as with Spot or Point Target collection modes, this field is filled with BCS blank spaces (0x20).	25	BCS-A	ddmmss.ssssXdddmmss.ssssY, ±dd.ddddddddd±ddd.ddddddddd or all spaces if not known (in general) Default is BCS spaces (0x20)	degrees	<R>
EXITELV	**Exit Elevation**. This field identifies the imaging operation exit point ground elevation above mean sea level (MSL).	6	BCS-A	-01000 to +30000 Default is BCS spaces (0x20)	feet or meters	<R>
TMAP	**True Map Angle**. This field provides the true map angle as defined below: SAR Systems: In Search modes, the true map angle is the angle between the ground projection of the line of sight from the aircraft and the scene centerline. In Spot modes, the true map angle is the angle, measured at the central reference point,	7	BCS-A	000.000-180.000 Default is BCS spaces (0x20)	degrees	<R>

ACFTB TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
	between the ground projection of the line of sight from the aircraft and a line parallel to the aircraft's desired track heading. EO-IR Systems: The true map angle is defined in the NED coordinate system with origin at the aircraft (aircraft local NED), as the angle between the scene entry line of sight and the instantaneous aircraft track-heading vector. The aircraft track-heading vector is obtained by rotating the north unit-vector of the aircraft local NED coordinate system in the aircraft local NE plane through the aircraft track-heading angle. The true map angle is measured in the slanted plane containing the scene entry line of sight and the aircraft track-heading vector. This angle is always positive.					
ROW_SPACING	**Row Spacing**. This field contains the row spacing measured at the center of the image. The row spacing is defined as the distance in the image plane between corresponding pixels of adjacent rows measured in feet or meters, or as the angular center-to-center distance (pitch) between corresponding pixels of adjacent rows measured in micro-radians. If the spacing (or associated units) is unknown, then the default value, 0000000, shall be entered.	7	BCS-N	0000000 (indicates unknown distance or units) Default is 0000000	meters, feet, or µ-radi-ans	R
ROW_SPACING_ UNITS	**Units of Row Spacing**. This field provides the units in which the row spacing is measured.	1	BCS-A	u (where u=unknown units)	N/A	R
COL_SPACING	**Column Spacing**. This field contains the column spacing measured at the center of the image. The column spacing is defined as the distance in the image plane between adjacent pixels within a row measured in feet or meters, or as the angular center-to-center distance (pitch) between adjacent pixels within a row measured in micro-radians. If the actual	7	BCS-N	0000000 (indicates unknown distance or units) Default is 0000000	meters, feet, or µ-radi-ans	R

ACFTB TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
	spacing (or associated units) is unknown, the default value of 0000000 shall be entered.					
COL_SPACING_ UNITS	**Units of Column Spacing**. This field provides the units in which the column spacing is measured.	1	BCS-A	u (where u=unknown units)	N/A	R
FOCAL_LENGTH	**Sensor Focal Length**. This field contains the effective distance from the optical lens to sensor element(s), used when either the ROW_SPACING_ UNITS or COL_SPACING_UNITS fields indicates µ-radians. A value of 999.99 indicates that the focal length is not available or not applicable to this sensor.	6	BCS-N	999.99	cm	R
SENSERIAL	**Sensor Vendor's Serial Number**. This field records the serial number of the line replaceable unit (LRU) containing EO-IR imaging electronics or SAR Receiver/Exciter involved in creating the imagery contained in this file.	6	BCS-A	000001-999999 Default is BCS spaces (0x20)	N/A	<R>
ABSWVER	**Airborne Software Version**. This field records the airborne software version (vvvv) and revision (rr) numbers of the software used to produce the point cloud data.	7	BCS-A	vvvv.rr Default is BCS spaces (0x20)	N/A	<R>
CAL_DATE	**Calibration Date**. This field provides the date that the sensor was last calibrated. CCYY is the century and year, MM is the month (01-12), and DD is the day of the month (01-31).	8	BCS-A	CCYYMMDD Default is BCS spaces (0x20)	UTC	<R>
PATCH_TOT	**Patch Total**. This field provides the total number of Patches contained in the imaging operation. Generally, this will also be consistent with the number of PATCH and/or CMETAA extensions contained in an imaging operation. For EO-IR imagery this field shall hold a value of 0000. Note: 0000 indicates no PATCH extensions present.	4	BCS-N	0000	N/A	R
MTI_TOT	**MTI Total**. This field provides the total number of	3	BCS-N	000	N/A	R

ACFTB TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
	MTIRP extensions contained in this file. Each MTIRP identifies 1 to 999 moving targets. For EO-IR imagery this field shall hold a value of 000.					

4.1.3 AIMIDB TRE for LiDAR Products

The Airborne Image Identification airborne support data extension (AIMIDB) is contained in the image extended subheader data section of the NITF2.1 Subheader. This tagged record extension should not be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Subheader. Table 4.1.3-1 provides the field descriptions and metadata population requirements for AIMIDB TRE used with LiDAR datasets. The AIMIDB TRE also contains metadata indicating the Mission Number and Country Code, which may be useful for image search and discovery.

The AIMIDB TRE is shown as required for airborne imagery in STDI-0002 Table 8-1.

For additional information refer to *STDI-0002, The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITFS).*

Table 4.1.3-1: AIMIDB TRE Fields for LiDAR Products.

AIMIDB TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	AIMIDB	N/A	R
CEL	**Length of CEDATA**. This field contains the length, in bytes, of the data stored in the TRE, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	00089	bytes	R
ACQUISITION_ DATE	**Acquisition Date and Time**. This field shall contain the date and time, referenced to UTC, of the collection in the format CCYYMMDDhhmmss, in which CC is the century, YY is the year, MM is the month (01-12), DD is the day of the month (01-31), hh is the hour (00-23), mm is the minute (00-59), and ss is the second (00-59). Field is equivalent to the IDATIM field in the Image Segment Subheader.	14	BCS-N	CCYYMMDDhhmmss	UTC	R
MISSION_NO	**Mission Number**. This field records the four-character descriptor of the mission, which has the form PPNN, where PP is the DIA Project Code (range is AA to ZZ) or U0 if the Project Code is unknown, and NN is an assigned two-digit identifier, for example, the last digits of FLIGHT_NO. UNKN shall be used if no specific descriptor is known.	4	BCS-A	PPNN, U0NN, UNKN (in general)	N/A	R
MISSION_IDENTI FICATION	**Name of the Mission**. This field records the Air Tasking Order Mission Number, if available, followed by BCS spaces. The value, NOT AVAIL. (two words separated by a BCS space and having a trailing period), shall be used if the mission name is unavailable.	10	BCS-A	Air Tasking Order Mission Number followed by BCS spaces (0x20) -or- NOT AVAIL. (in general)	N/A	R

AIMIDB TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
FLIGHT_NO	**Flight Number**. This field identifies a particular flight with a flight number in the range 01 to 09. Flight 01 shall be the first flight of the day, flight 02 the second, etc. In order to ensure uniqueness in the image ID, if the aircraft mission extends across midnight UTC, the flight number shall be 0x (where x is in the range 0 to 9) on images acquired before midnight UTC and Ax on images acquired after midnight UTC; for extended missions Bx, …, Zx shall designate images acquired on subsequent days. The value 00 indicates the flight number is unavailable.	2	BCS-A	00, 01 to 09, A1 to A9, B1 to B9, …, Z1 to Z9 (in general)	N/A	R
OP_NUM	**Image Operation Number**. This field identifies the image operation number. This value is reset to 001 at the start of each flight and incremented by 1 for each distinct imaging operation. Additionally, the number is reset to 001 following operation number 999. A value of 000 indicates the airborne system does not number imaging operations. For imagery derived from video systems this field contains the frame number within the ACQUISITION_DATE time.	3	BCS-N	000, 001-999 (in general)	N/A	R
CURRENT_SEGMENT	**Current Segment ID**. This field identifies which segment (piece) of an imaging operation contains this image. AA is the first segment; AB is the second segment, etc. This field shall contain AA if the image is not segmented (i.e., consists of a single segment).	2	BCS-A	AA-ZZ	N/A	R

AIMIDB TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
REPRO_NUM	**Reprocess Number**. This field identifies whether the image is in its original processing state, or if it has been reprocessed or enhanced. For SAR imagery this field indicates whether the data was reprocessed to overcome initial processing failures, or has been enhanced. A value of 00 in this field indicates that the data is an originally processed image; a value of 01 indicates the first reprocess/enhancement, etc. For visible and infrared imagery this field shall contain 00 to indicate no reprocessing or enhancement.	2	BCS-N	00-99 (in general)	N/A	R
REPLAY	**Replay**. This field indicates whether the data was reprocessed to overcome initial processing failures, or retransmitted to overcome transmission errors. A 000 in this field indicates that the data is an originally processed and transmitted image, a value in the ranges of G01 to G99 or P01 to P99 indicates the data is reprocessed, and a value in the range T01 to T99 indicates it was retransmitted.	3	BCS-A	000, G01 to G99, P01 to P99, or T01 to T99 (in general) Default is BCS spaces (0x20)	N/A	<R>
RESERVED_001	**Reserved Field 001**. Reserved field for future use.	1	BCS-A	A BCS space (0x20)	N/A	R
START_TILE_COLUMN	**Starting Tile Column Number**. For tiled (blocked) sub-images, this field records the number of the first tile within the CURRENT_SEGMENT, relative to tiling at the start of the imaging operation. Tiles are rectangular arrays of pixels (dimensionally defined by the NITF image subheader NPPBH and NPPBV fields) that subdivide an image. For un-tiled (single block) images this field shall contain 001.	3	BCS-N	001-099 (in general)	N/A	R
START_TILE_ROW	**Starting Tile Row Number**. For tiled (blocked) sub-images, this field records the number of the first tile within the CURRENT_SEGMENT, relative to tiling at the start of the imaging operation. For un-tiled (single block) images this field shall be 00001.	5	BCS-N	00001-99999 (in general)	N/A	R

AIMIDB TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
END_SEGMENT	**Ending Segment**. This field contains the ending segment ID of the imaging operation. This field shall contain AA if the image is not segmented (i.e., consists of a single segment). During an extended imaging operation the end segment may not be known or predictable before it is collected; the value 00 (numeric zeros) shall indicate that the ending segment of the operation is unknown.	2	BCS-A	00, AA-ZZ (in general)	N/A	R
END_TILE_COLUMN	**Ending Tile Column Number**. For tiled (blocked) sub-images, this field records the number of the last tile within the END_SEGMENT, relative to tiling at the start of the imaging operation. For un-tiled (single block) images this field shall contain 001.	3	BCS-N	001-099 (in general)	N/A	R
END_TILE_ROW	**Ending Tile Row Number**. For tiled (blocked) sub-images, this field records the number of the last tile within the END_SEGMENT, relative to tiling at the start of the imaging operation. For un-tiled (single block) images this field shall contain 00001.	5	BCS-N	00001-99999 (in general)	N/A	R
COUNTRY	**Country Code**. This field contains the two-letter code (digraph) defining the country for the reference point of the image. Standard codes may be found in FIPS PUB 10-4.	2	BCS-A	AA to ZZ Default is BSC spaces (0x20)	N/A	<R>
RESERVED_002	**Reserved Field 002**. Reserved field for future use.	4	BCS-A	4 BCS spaces (0x20)	N/A	R

AIMIDB TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
LOCATION	**Location**. This field contains the location of the natural reference point of the sensor, which provides a rough indication of geographic coverage. The format ddmmX represents degrees (00 to 89) and minutes (00 to 59) of latitude, with X=N or S for North or South, and dddmmY represents degrees (000 to 179) and minutes (00 to 59) of longitude, with Y=E or W for east or west, respectively. For SAR imagery the reference point is normally the center of the first image block. For EO-IR imagery the reference point for framing sensors is the center of the frame; for continuous sensors, it is the center of the first row of the image. Note: Because the location is only reported to one arc-minute, it may be more than a half-mile in error, and not actually represent any point within the boundary of the image. BCS spaces indicate that the location is unavailable.	11	BCS-A	ddmmXdddmmY Default is BCS spaces (0x20)	degrees	<R>
RESERVED_003	**Reserved Field 003**. Reserved field for future use.	13	BCS-A	13 BCS spaces (0x20)	N/A	R

4.1.4 CSCRNA TRE for LiDAR Products

The Corner Footprint support extension (CSCRNA) is contained in the extended subheader data section of the NITF2.1 Image Segment Subheader. This tagged record extension may be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Image Segment Subheader. Table 4.1.4-1 provides the field descriptions and metadata population requirements for CSCRNA TRE used with LiDAR datasets. The use of this TRE is required for all such datasets.

The CSCRNA TRE provides 4-corner geographic coordinates of the geo-rectified Intensity and Elevation data with a precision greater than can be placed in the image segment subheader IGEOLO metadata field.

For additional information refer to *STDI-0006, National* Imagery Transmission Format (NITF) Version 2.1 Commercial Dataset Requirements Document (NCDRD).

Table 4.1.4-1: CSCRNA TRE Fields for LiDAR Products.

CSCRNA TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	CSCRNA	N/A	R
CEL	**Length of CEDATA**. This field contains the length, in bytes, of the data stored in the TRE, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	00109	bytes	R
PREDICT_CORNERS	**Predicted Corners Flag**. Indicator of whether the corner coordinates are predicted or are based on actual measurements. Y = Predicted N = Actual	1	BCS-A	Y or N	N/A	R
ULCNR_LAT	**Image Corner Latitude Upper Left Corner of Image**. The latitude of the upper left corner of the image. Corner line and sample pair (i.e. corner pixel) is projected from the image plane to the reference ellipsoid (i.e., WGS-84) along the corner pixel's Earth Centered Earth Fixed (ECEF)6 vector and then converted to Geodetic latitude. +dd.ddddd dd.ddddd = decimal degrees '+' = northern hemisphere '-' = southern hemisphere	9	BCS-N	-90.00000 to +90.00000	Degrees	R

CSCRNA TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
ULCNR_LONG	**Image Corner Longitude Upper Left Corner of Image**. The longitude of the upper left corner of the image. Corner line and sample pair (i.e. corner pixel) is projected from the image plane to the reference ellipsoid (i.e., WGS-84) along the corner pixel's ECEF vector and then converted to Geodetic longitude. +ddd.ddddd ddd.ddddd = decimal degrees '+' = eastern hemisphere '-' = western hemisphere	10	BCS-N	-179.99999 to +180.00000	Degrees	R
ULCNR_HT	**Image Corner Height at Upper Left Corner of Image**. The height of the upper left corner of the image, referenced to the reference ellipsoid (i.e., WGS-84)	8	BCS-N	-00610.0 to +10668.0	Meters	R
URCNR_LAT	**Image Corner Latitude Upper Right Corner of Image**. The latitude of the upper right corner of the image. Corner line and sample pair (i.e. corner pixel) is projected from the image plane to the reference ellipsoid (i.e., WGS-84) along the corner pixel's ECEF vector and then converted to Geodetic latitude. +dd.ddddd dd.ddddd = decimal degrees '+' = northern hemisphere '-' = southern hemisphere	9	BCS-N	-90.00000 to +90.00000	Degrees	R

CSCRNA TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
URCNR_LONG	**Image Corner Longitude Upper Right Corner of Image**. The longitude of the upper right corner of the image. Corner line and sample pair (i.e., corner pixel) is projected from the image plane to the reference ellipsoid (i.e., WGS-84) along the corner pixel's ECEF vector and then converted to Geodetic longitude. +ddd.ddddd ddd.ddddd = decimal degrees '+' = eastern hemisphere '-' = western hemisphere	10	BCS-N	-179.99999 to +180.00000	Degrees	R
URCNR_HT	**Image Corner Height at Upper Right Corner of Image**. The height of the upper right corner of the image referenced to the reference ellipsoid (i.e., WGS-84)	8	BCS-N	-00610.0 to +10668.0	Meters	R
LRCNR_LAT	**Image Corner Latitude Lower Right Corner of Image**. The latitude of the lower right corner of the image. Corner line and sample pair (i.e. corner pixel) is projected from the image plane to the reference ellipsoid (i.e., WGS-84) along the corner pixel's ECEF vector and then converted to Geodetic latitude. +dd.ddddd dd.ddddd = decimal degrees '+' = northern hemisphere '-' = southern hemisphere	9	BCS-N	-90.00000 to +90.00000	Degrees	R

CSCRNA TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
LRCNR_LONG	**Image Corner Longitude Lower Right Corner of Image**. The longitude of the lower right corner of the image. Corner line and sample pair (i.e. corner pixel) is projected from the image plane to the reference ellipsoid (i.e., WGS-84) along the corner pixel's ECEF vector and then converted to Geodetic longitude. +ddd.ddddd ddd.ddddd = decimal degrees '+' = eastern hemisphere '-' = western hemisphere	10	BCS-N	-179.99999 to +180.00000	Degrees	R
LRCNR_HT	**Image Corner Height at Lower Right Corner of Image**. The height of the lower right corner of the image referenced to the reference ellipsoid (i.e., WGS-84).	8	BCS-N	-00610.0 to +10668.0	Meters	R
LLCNR_LAT	**Image Corner Latitude Lower Left Corner of Image**. The latitude of the lower left corner of the image. Corner line and sample pair (i.e. corner pixel) is projected from the image plane to the reference ellipsoid (i.e., WGS-84) along the corner pixel's ECEF vector and then converted to Geodetic latitude. +dd.ddddd dd.ddddd = decimal degrees '+' = northern hemisphere '-' = southern hemisphere	9	BCS-N	-90.00000 to +90.00000	Degrees	R

CSCRNA TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
LLCNR_LONG	**Image Corner Longitude Lower Left Corner of Image**. The longitude of the lower left corner of the image. Corner line and sample pair (i.e., corner pixel) is projected from the image plane to the reference ellipsoid (i.e., WGS-84) along the corner pixel's ECEF vector and then converted to Geodetic longitude. +ddd.ddddd ddd.ddddd = decimal degrees '+' = eastern hemisphere '-' = western hemisphere	10	BCS-N	-179.99999 to +180.00000	Degrees	R
LLCNR_HT	**Image Corner Height at Lower Left Corner of Image**. The height of the lower left corner of the standard image referenced to the reference ellipsoid (i.e., WGS-84).	8	BCS-N	-00610.0 to +10668.0	Meters	R

4.1.5 GEOLOB TRE for LiDAR Products

The Local Geographic (lat/lon) Coordinate System support extension (GEOLOB) is contained in the extended subheader data section of the NITF2.1 Image Segment Subheader. This tagged record extension may be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Image Segment Subheader. Table 4.1.5-1 provides the field descriptions and metadata population requirements for GEOLOB TRE used with LiDAR datasets. The use of this TRE is required for all such datasets. Its content applies only to the Intensity or Elevation image segment in which it is recorded.

For additional information refer to *STANAG 7074, Digital Geographic Information Exchange Standard (DIGEST), Part 2 Annex D.*

Table 4.1.5-1: GEOLOB TRE Fields for LiDAR Products.

GEOLOB TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	GEOLOB	N/A	R
CEL	**Length of CEDATA**. This field contains the length, in bytes, of the data stored in the TRE, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	00048	bytes	R
ARV	**Longitude density**. This field shall contain the pixel ground spacing in E/W direction that is the number of pixels or elements intervals in 360°.	9	BCS-N	000000002 to 999999999		R
BRV	**Latitude density**. This field shall contain the pixel ground spacing in N/S direction that is the number of pixels or elements intervals in 360°.	9	BCS-N	000000002 to 999999999		R
LSO	**Longitude of Reference Origin**. This field shall contain the longitude of the origin pixel (row number 0, column number 0) in the absolute coordinate system.	15	BCS-N	Longitude in decimal degrees (signed floating point) where the + sign represents eastern hemisphere, and the - sign represents western hemisphere. The preferred form is: ±ddd.dddddddddd (The + sign may be omitted for positive values.)		R
PSO	**Latitude of Reference Origin**. This field shall contain the latitude of the origin pixel (row number 0, column number 0) in the absolute coordinate system.	15	BCS-N	Latitude in decimal degrees (signed floating point) where the + sign represents northern hemisphere, and the – sign represents southern hemisphere. The preferred form is: ±ddd.dddddddddd (The + sign may be omitted for positive values.)		R

4.1.6 GEOPSB TRE for LiDAR Products

The Geo Positioning Information support extension (GEOPSB) is contained in the extended subheader data section of the NITF2.1 Image Segment Subheader. This tagged record extension may be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Image Segment Subheader. Table 4.1.6-1 provides the field descriptions and metadata population requirements for GEOPSB TRE used with LiDAR datasets. The use of this TRE is required for all such datasets. Its content applies only to the Intensity or Elevation image segment in which it is recorded.

For additional information refer to *STANAG 7074, Digital Geographic Information Exchange Standard (DIGEST), Part 2 Annex D. Note that the GEOPSB will be located in the image subheader vice the file header as identified in DIGEST.*

Table 4.1.6-1: GEOPSB TRE Fields for LiDAR Products.

GEOPSB TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	GEOPSB	N/A	R
CEL	**Length of CEDATA**. This field contains the length, in bytes, of the data stored in the TRE, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	00443	bytes	R
TYP	**Coordinate System Type**. This field shall contain the type of coordinate system to which the Image Segment refers. Valid values are **GEO** for a geographic coordinate system (longitude & latitude), **MAP** for a cartographic (grid) coordinate system (easting & northing) and **DIG** for a geographic or cartographic coordinate system registered through location grids or registration points. See clause D1.2.2 for details. The default value is **MAP**.	3	BCS-A	GEO		R
UNI	**Coordinate Units**. This field shall contain the units of measure to which the Image Segment refers. Valid values are **SEC** (Decimal seconds of arc), **DEG** (Decimal degrees) and **M** (Metres). The value must be consistent with the coordinate system type. **SEC** and **DEG** are not allowed when the coordinate system type is MAP. **M** is not allowed when the coordinate system type is GEO. The PRJPS extension is expected when the value is **M**. The default value is **M**.	3	BCS-A	DEG		R
DAG	**Geodetic Datum Name**. This field shall contain the name of the geodetic datum to which the Image Segment refers. The default value is **World Geodetic System 1984**.	80	BCS-A	World Geodetic System 1984 See DIGEST Edition 2.1, Part 3-6		R

GEOPSB TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
DCD	**Geodetic Datum Code**. This field shall contain the code of the geodetic datum to which the Image Segment refers. The default value is **WGE**.	4	BCS-A	WGE See DIGEST Edition 2.1, Part 3-6		R
ELL	**Ellipsoid Name**. This field shall contain the name of the ellipsoid to which the Image Segment refers. The default value is **World Geodetic System 1984**.	80	BCS-A	World Geodetic System 1984 See DIGEST Edition 2.1, Part 3-6		R
ELC	**Ellipsoid Code**. This field shall contain the code of the ellipsoid to which the Image Segment refers. The default value is **WE**.	3	BCS-A	WE See DIGEST Edition 2.1, Part 3-6		R
DVR	**Vertical Datum Reference**. This field shall contain the name of the vertical datum reference to which the Image Segment refers, or **BCS Spaces** if no elevation value appears in the Image Segment. The default name is **Geodetic**.	80	BCS-A	Geodetic See DIGEST Edition 2.1, Part 3-6		<R>
VDCDVR	**Code (Category) of Vertical Reference**. This field shall contain the code (or category) of the vertical reference to which the Image Segment refers, or **BCS Spaces** if no elevation value appears in the Image Segment. The default code is **GEOD**.	4	BCS-A	GEOD See DIGEST Edition 2.1, Part 3-6		<R>
SDA	**Sounding Datum Name**. This field shall contain the name of the sounding datum to which the Image Segment refers, or **BCS Spaces** if no sounding appears in the Image Segment. The default value is **Mean Sea**.	80	BCS-A	BCS Spaces (0x20) See DIGEST Edition 2.1, Part 3-6		<R>

GEOPSB TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
VDCSDA	**Code for Sounding Datum**. This field shall contain the code of the sounding datum to which the Image Segment refers, or **BCS Spaces** if no sounding appears in the Image Segment. The default valid code is **MSL**.	4	BCS-A	BCS Spaces (0x20) See DIGEST Edition 2.1, Part 3-6		<R>
ZOR	**Z values False Origin**. This field shall contain the elevation and depth false origin for Z values to which the Image Segment refers. The default value is **000000000000000**, which implies that there is no projection false Z origin.	15	BCS-N positive integer	000000000000000		R
GRD	**Grid Code**. This field shall contain the identification code of the grid system to which the Image Segment refers, or **BCS Spaces**. The default value is **BCS Spaces**.	3	BCS-A	BCS Spaces (0x20) See DIGEST Edition 2.1, Part 3-6		<R>
GRN	**Grid Description**. If the GRD Field value is not BCS Spaces, this field can contain a text description of the grid system. The default value is **BCS Spaces**.	80	BCS-A	BCS Spaces (0x20)		<R>
ZNA	**Grid Zone number**. This field shall contain the zone number when the GRD Field contains a significant grid code and the corresponding grid system comprises more than one zone. Defaulted to **0000** otherwise.	4	BCS-N integer	0000 See DIGEST Edition 2.1, Part 3-6		R

4.1.7 HISTOA TRE for LiDAR Products

The Softcopy History tagged record extension (HISTOA) is contained in the image extended subheader data section of the NITF2.1 Image Segment Subheader. This tagged record extension (TRE) should not be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Image Segment Subheader. Table 4.1.7-1 provides the field descriptions and metadata population requirements for the HISTOA TRE used with LiDAR datasets. This TRE is required for all such datasets.

For the initial production of Intensity and Elevation image segments from the associated LiDAR point cloud dataset, the processing events to be recorded in the HISTOA TRE may include:

- Geometric transformations
- Dynamic Range Adjustments (DRA)
- Output Bit Depth transformations
- Output Pixel Type transformations
- Output Bandwidth Compression

For additional information refer to *STDI-0002, The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITFS).*

Table 4.1.7-1: HISTOA TRE Fields for LiDAR Products.

HISTOA TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	HISTOA	N/A	R
CEL	**Length of CEDATA**. This field contains the length, in bytes, of the data stored in the TRE, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	00115 to 83512	bytes	R
SYSTYPE	**System Type**. This field shall contain the name of the sensor from which the original image was collected. The codes in the SYSTYPE field shall be left justified and the remainder of the field filled with BCS spaces (0x20) to a full 20 characters.	20	BCS-A	See listing of NITF registered field values: http://jitc.fhu.disa.mil/nitf/tag_reg/histoa/ Default is TBD followed by 17 BCS spaces (0x20).	N/A	R
PC	**Prior Compression**. This field shall contain an alphanumeric string that indicates if bandwidth compression/expansion was applied to the image prior to NITF image creation. This field should be used in conjunction with the PE field to determine the state of the image prior to NITF formation. The valid field codes for the PC field are 4 byte character strings. The first two characters indicate the type of compression such as DCT or DPCM. The next two characters indicate either the bit-rate or the quality level. The types of compression are indicated by the following codes: DP43 – DPCM to 4.3 bpp DC13 – DCT to 1.3 bpp DC23 – DCT to 2.3 bpp NJNL – NITFIRD JPEG Lossless	12	BCS-A	NONE00000000 Default is UNKC00000000	N/A	R

HISTOA TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
	NJQ0 – NITFIRD JPEG Quality Level 0 NJQ1 – NITFIRD JPEG Quality Level 1 NJQ2 – NITFIRD JPEG Quality Level 2 C11D – NITF Bi-level 1D C12S – NITF Bi-level 2DS C12H – NITF Bi-level 2DH M11D – NITF Bi-level with masked blocks 1D M12S – NITF Bi-level with masked blocks 2DS M12H – NITF Bi-level with masked blocks 2DH C207 – NITF ARIDPCM to 0.75 bpp C214 – NITF ARIDPCM to 1.40 bpp C223 – NITF ARIDPCM to 2.30 bpp C245 – NITF ARIDPCM to 4.50 bpp C3Q0 – NITF Lossy JPEG Q0 Custom Tables C3Q1 – NITF Lossy JPEG Q1 Default Tables C3Q2 – NITF Lossy JPEG Q2 Default Tables C3Q3 – NITF Lossy JPEG Q3 Default Tables C3Q4 – NITF Lossy JPEG Q4 Default Tables C3Q5 – NITF Lossy JPEG Q5 Default Tables M3Q0 – NITF Lossy JPEG with masked blocks Q0 Custom Tables M3Q1 – NITF Lossy JPEG with masked blocks Q1 Default Tables M3Q2 – NITF Lossy JPEG with masked blocks Q2 Default Tables M3Q3 – NITF Lossy JPEG with masked blocks Q3 Default Tables M3Q4 – NITF Lossy JPEG with masked blocks Q4 Default Tables M3Q5 – NITF Lossy JPEG with masked blocks Q5 Default Tables C4LO – NITF Vector Quantization Lossy M4LO – NITF Vector Quantization with masked blocks					

HISTOA TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
	C5NL – NITF Lossless JPEG M5NL – NITF Lossless JPEG with masked blocks NC00 – NITF Uncompressed NM00 – NITF Uncompressed with masked blocks I1Q1 – NITF Downsample JPEG Q1 I1Q2 – NITF Downsample JPEG Q2 I1Q3 – NITF Downsample JPEG Q3 I1Q4 – NITF Downsample JPEG Q4 I1Q5 – NITF Downsample JPEG Q5 WVLO – Wavelet Lossy WVNL – Wavelet Lossless JP20 – JPEG 2000 NONE – No Compression UNKC – Unknown Compression The entire PC field is 12 bytes long to allow for the concatenation of up to three compression algorithms. Consecutive 4-byte character strings shall indicate the application of two or three compression algorithms in succession. If only one compression algorithm is applied then the last eight characters are zeros. If the NITF creator does not know where the image came from or what processing has been applied to it, then the code for unknown compression (UNKC) shall be used. Examples of valid codes for the PC field are shown below. The DP43DC130000 code indicates that a concatenation of the 4.3 DPCM and the 1.3 DCT compression and expansion was applied to the image prior to its NITF formation. The NONE00000000 code indicates that no compression was applied to the image prior to its NITF formation.					

HISTOA TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
PE	**Prior Enhancements**. This field shall contain an alphanumeric string that indicates if any enhancements were applied to the image prior to NITF image creation. This field should be used in conjunction with the PC field to determine the state of the image prior to NITF formation. The valid field codes for the PC field are given below: EH08 – Enhanced 8 bpp from IDEX EH11 – Enhanced 11 bpp from IDEX UE08 – 8 bpp with DRA but no enhancements from IDEX UE11 – Unenhanced 11 bpp from IDEX DGHC – Digitized Hardcopy UNKP – Unknown Processing NONE – No prior processing The first four codes explicitly define the types of ODS (Output Data Server) products that are available for NITF formation. Additional codes may be added for airborne systems. If the NITF creator does not know where the image came from or what processing has been applied to it, then the code for unknown processing (UNKP) shall be used.	4	BCS-A	NONE	N/A	R
REMAP_FLAG	**System Specific Remap**. This field shall indicate whether or not a system specific remap has been applied to the image. The valid field codes are 0-9, and a blank (BCS 0x20), but 2-9 are reserved for future use. A value of 0 means that no system specific remap has been applied. A value of 1 means that system specific remap has been applied to the image. For commercial and airborne imagery, this field does not apply at this time and should be filled with a space. Values 2-9 are reserved for future use and shall not be used at this time.	1	BCS-A	BCS space (0x20)	N/A	R

HISTOA TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
LUTID	**Data Mapping ID from the ESD**. This field shall contain the DMID (Data Mapping ID). See section L.4.1 of STDI-0002. The valid field codes are 07, 08, and 12-64. A value of 07 or 08 indicates that the image is PEDF (Piecewise Extended Density Format). A value between 12 and 64 indicates that the image is a Linlog formatted image. A value of 00 indicates that neither Linlog nor PEDF is used for this image. Numbers between 01 and 06, 09, 10, and 11 are reserved and should not be used at this time. There are no valid DMID values greater than 64. NITF users can use this field to help determine what type of processing should be applied to the image.	2	BCS-N	00	N/A	R
NEVENTS	**Number of Processing Events**. This field shall contain the number of processing events associated with the image. The tag is designed to record up to 99 separate processing events. The valid field codes are 01 to 99. The processing events are listed in chronological order, starting with the first event and ending with the most recent processing event. At a minimum, the first processing event shall be the processing immediately following the generation of the NITF formatted image; however, if practical, the originator of the NITF image can create the HISTOA TRE earlier – with the creation of the NITF formatted image. In that instance, the first processing event would be the creation of the NITF formatted image. Each successive processing event is to record what transformations have been applied to the image, once the image has been processed and saved.	2	BCS-N	01 to 99 (in general)	N/A	R

HISTOA TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
PDATEnn	**Processing Date and Time**. This field shall contain the date and time (UTC) on which this processing event occurred. The valid form of the field is CCYYMMDDhhmmss, where CC is the century (00 to 99), YY is the year (00 to 99), MM is the month (01 to 12), DD is the day (01 to 31), hh is the hour (00 to 23), mm is the minute (00 to 59), and ss is the second (00 to 59). UTC (Zulu) is assumed to be the time zone designator to express the time of day. This field can be used in conjunction with the FDT field in the NITF file header to determine if the History Tag has been updated each time the image was processed and saved. If the PDATE field and the FDT field are identical, then the History Tag has been properly updated. If the fields are not identical, then the History Tag has not been properly updated and the data may not be accurate or timely.	14	BCS-N	CCYYMMDDhhmmss	UTC	R
PSITEnn	**Processing Site**. This field shall contain the name of the site or segment that performed the processing event. This 10-character alphanumeric field is free form text. Examples of PSITE entries are FOS, JWAC, or CENTCOM.	10	BCS-A	alphanumeric (in general)	N/A	R
PASnn	**Softcopy Processing Application**. This field shall contain the processing application software used to perform the processing steps cited in the event (e.g. IDEX, VITEC, or DIEPS). The version number of the application would also be helpful to include in this field.	10	BCS-A	alphanumeric (in general)	N/A	R
NIPCOMnn	**Number of Image Processing Comments**. This field shall contain the valid number of image processing comments for this processing event. The valid field codes are 0 to 9.	1	BCS-N	0 to 9 (in general)	N/A	R

HISTOA TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
IPCOMnn	**nth Image Processing Comment**. This field shall contain the nth line of comment text, based on the value of the NIPCOM field. This field shall be omitted if the value of NIPCOM is zero. The fields IPCOM1 to IPCOMn, if present, shall contain free form alphanumeric text. They are intended for use as a single comment block and shall be used that way. This comment field shall be used to clarify or indicate special processing not accounted for in the Processing Event fields. Reasons for populating this field would be to indicate alternate processing for multi-spectral imagery, to indicate the order of S/C processing steps contained within a single processing event, or to inform downstream users of potential problems with the image.	80	BCS-A	Description of Processing Event	N/A	C
IBPPnn	**Input Bit Depth (Actual)**. This field shall contain the number of significant bits for each pixel before the processing functions denoted in the processing event have been performed and before compression. This type of pixel depth description is consistent with the ABPP field within the NITF image subheader. For example, if an 11-bpp word is stored in 16 bits, this field would contain 11 and the NBPP field in the NITF image subheader would contain 16. The valid IBPP field codes are 01 to 64, indicating 1 to 64 bpp.	2	BCS-N	01 to 64	bits per pixel	R

HISTOA TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
IPVTYPEnn	**Input Pixel Value Type**. This field shall contain an indicator of the type of computer representation used for the value of each pixel before the processing functions denoted in the processing event have been performed and before compression. Valid entries are INT for integer, SI for 2's complement signed integer, R for real, C for complex, B for bi-level, and U for user defined. The data bits of INT and SI values shall appear in the file in order of significance, beginning with the most significant bit (MSB) and ending with the least significant bit (LSB). INT and SI data types shall be limited to 16 bits. R values shall be represented according to IEEE 32-bit floating-point representation (IEEE 754). C values shall be represented with the Real and Imaginary parts each represented in IEEE 32-bit floating-point representation (IEEE 754) and appearing in adjacent four-byte blocks, first Real, then Imaginary. B (bi-level) pixel values shall be represented as single bits with value 1 or 0.	3	BCS-A	alphanumeric (in general) INT, SI, R, C, B, U	N/A	R
INBWCnn	**Input Bandwidth Compression**. This field shall indicate the type of bandwidth compression or expansion that has been applied to the image prior to any enhancements desired in the processing event. The valid field codes to describe each type of compression are 5 byte character strings. The first two characters indicate the type of compression such as DCT or DPCM. The next two characters indicate either the bit rate or the quality level. The last character indicates if the process is compression or an expansion. Compression is denoted by a C, an E denotes expansion, and 0 indicates that neither process occurred. The types of compression are indicated by the following codes:	10	BCS-A	NONE000000	N/A	R

HISTOA TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
	DP43 – DPCM to 4.3 bpp DC13 – DCT to 1.3 bpp DC23 – DCT to 2.3 bpp NJNL – NITFIRD JPEG Lossless NJQ0 – NITFIRD JPEG Quality Level 0 NJQ1 – NITFIRD JPEG Quality Level 1 NJQ2 – NITFIRD JPEG Quality Level 2 C11D – NITF Bi-level 1D C12S – NITF Bi-level 2DS C12H – NITF Bi-level 2DH M11D – NITF Bi-level with masked blocks 1D M12S – NITF Bi-level with masked blocks 2DS M12H – NITF Bi-level with masked blocks 2DH C207 – NITF ARIDPCM to 0.75 bpp C214 – NITF ARIDPCM to 1.40 bpp C223 – NITF ARIDPCM to 2.30 bpp C245 – NITF ARIDPCM to 4.50 bpp C3Q0 – NITF Lossy JPEG Q0 Custom Tables C3Q1 – NITF Lossy JPEG Q1 Default Tables C3Q2 – NITF Lossy JPEG Q2 Default Tables C3Q3 – NITF Lossy JPEG Q3 Default Tables C3Q4 – NITF Lossy JPEG Q4 Default Tables C3Q5 – NITF Lossy JPEG Q5 Default Tables M3Q0 – NITF Lossy JPEG with masked blocks Q0 Custom Tables M3Q1 – NITF Lossy JPEG with masked blocks Q1 Default Tables M3Q2 – NITF Lossy JPEG with masked blocks Q2 Default Tables M3Q3 – NITF Lossy JPEG with masked blocks Q3 Default Tables M3Q4 – NITF Lossy JPEG with masked blocks Q4 Default Tables					

HISTOA TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
	M3Q5 – NITF Lossy JPEG with masked blocks Q5 Default Tables C4LO – NITF Vector Quantization Lossy M4LO – NITF Vector Quantization with masked blocks C5NL – NITF Lossless JPEG M5NL – NITF Lossless JPEG with masked blocks NC00 – NITF Uncompressed NM00 – NITF Uncompressed with masked blocks I1Q1 – NITF Downsample JPEG Q1 I1Q2 – NITF Downsample JPEG Q2 I1Q3 – NITF Downsample JPEG Q3 I1Q4 – NITF Downsample JPEG Q4 I1Q5 – NITF Downsample JPEG Q5 WVLO – Wavelet Lossy WVNL – Wavelet Lossless JP20 – JPEG 2000 NONE – No Compression UNKC – Unknown Compression OTLO – Unknown Lossy Compression; requires mandatory IPCOM entry to explain technique or source OTNL – Unknown Lossless Compression; requires mandatory IPCOM entry to explain technique or source The entire INBWC field is 10 bytes long to allow for the concatenation of up to two compression algorithms. Two consecutive 5-byte character strings shall indicate the application of two compression algorithms in succession. If only one operation is performed, then the remaining five characters are zeros. Examples of valid codes for the INBWC field are shown below. The DP43E00000 code indicates					

HISTOA TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
	that a 4.3 DPCM compressed input image was expanded prior to NITF formation. The DC13E00000 code indicates that a 1.3 DCT compressed input image was expanded prior to NITF formation. The NONE000000 code indicates that the input image to the NITF formation process was uncompressed.					
DISP_FLAGnn	**Display-Ready Flag**. This field shall indicate if the image is "Display Ready". The DISP_FLAG field applies only to systems that do not inherently produce displayable imagery. Display-Ready data has had a system-specific transformation applied to it that is described in section L.4.1 of STDI-0002. The valid field codes are 0 to 9 and a blank (BCS 0x20). A value of 0 means that the image is not Display-Ready and must be converted to a displayable format, using the pre-defined mappings for LinLog or PEDF formats. A value of 1 means that the image is Display-Ready and needs only basic tonal processing and device compensation for correct display. A value of space (BCS 0x20) means that the image is inherently displayable. Values 2 to 9 are reserved for future use and shall not be used at this time.	1	BCS-A	0, 1, or blank space (BCS 0x20)	N/A	R
ROT_FLAGnn	**Image Rotation**. This field shall indicate if the image has been rotated. The valid field codes are 0 and 1. A value of 0 means that the image has not been rotated. A value of 1 means that the image has been rotated. If this field is equal to 1, then the ROT_ANGLE field must be filled with the angle of rotation.	1	BCS-N	0	N/A	R

HISTOA TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
ROT_ANGLEnn	**Angle of Rotation**. This field shall contain the angle in degrees that the image has been rotated, where a positive angle denotes clockwise rotation. The valid field codes are 000.0000 to 359.9999. This field is conditional on the ROT_FLAG field being equal to 1. If the rotation has included an interpolation, then the interpolation method shall be described in the comment sections.	8	BCS-N	omit	degrees	C
ASYM_FLAGnn	**Asymmetric Correction**. This field shall indicate if asymmetric correction has been applied to the image. This processing step only applies to certain types of imagery. The valid field codes are 0 and 1, and a blank (BCS 0x20). A value of 0 means that asymmetric correction has not yet been applied to the image. A value of 1 means that asymmetric correction has been applied to the image. A value of space (BCS 0x20) means that imagery did not need correcting. If this field is equal to 1, then the ZOOMROW and ZOOMCOL fields must be filled with the magnification levels in the row (line) and column (element) directions, respectively.	1	BCS-A	blank space (BCS 0x20)	N/A	R
ZOOMROWnn	**Magnification in Line (Row) Direction**. This field shall contain the level of magnification that was applied to the image in the line (row) direction, if asymmetric correction was applied. The valid field codes are 00.0000 to 99.9999. The level of magnification is relative to the input image at this processing step. This field is conditional on the ASYM_FLAG field.	7	BCS-N	omit	N/A	C

HISTOA TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
ZOOMCOLnn	**Magnification in Element (Column) Direction**. This field shall contain the level of magnification that was applied to the image in the element (column) direction, if asymmetric correction was applied. The valid field codes are 00.0000 to 99.9999. The level of magnification is relative to the input image at this processing step. This field is conditional on the ASYM_FLAG field.	7	BCS-N	omit	N/A	C
PROJ_FLAGnn	**Image Projection**. This field shall indicate if the image has been projected from the collection geometry into another geometry that is more suitable for display. The valid field codes are 0 and 1. A value of 0 means that no geometric transformation has been applied to the image, meaning it is probably still in the collection geometry. A value of 1 means that the image has been projected into another geometry. If this field is equal to 1, then a description of the projection or rectification shall be given in the comment section.	1	BCS-N	0 (indicates no geometric transformation was applied) or 1 (indicates that image has been project into another geometry)	N/A	R
SHARP_FLAGnn	**Sharpening**. This field shall indicate if the image has been passed through a sharpening operation. The valid field codes are 0 and 1. A value of 0 means that no sharpening has been applied to the image. A value of 1 means that sharpening has been applied to the image. If this field is equal to 1, then the SHARPFAM and SHARPMEM fields must be filled with the appropriate numbers. Refer to paragraph L.5 of STDI-0002 for a more complete description of the sharpening kernel database.	1	BCS-N	0	N/A	R
The presence of fields SHARPFAMnn and SHARPMEMnn are conditional upon SHARP_FLAGnn = 1.						

HISTOA TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
SHARPFAMnn	**Sharpening Family Number**. This field shall contain the number of the sharpening family, if a sharpening operation was applied to the image. The valid field codes are -1, 00 to 99. This field is conditional on the SHARP_FLAG field. Although the IDEX sharpening family numbers are one-based, many commercial softcopy systems use a zero-based system for their databases. For example, IDEX family 5 would be family 4 for many other softcopy systems. If the sharpening kernel is not part of the existing group of families and members, a value of -1 shall be placed in the field and the nature of the sharpening kernel specified in the comment section. Refer to paragraph L.5 of STDI-0002 for a more complete description of the sharpening kernel database.	2	BCS-N	omit	N/A	C
SHARPMEMnn	**Sharpening Member Number**. This field shall contain the number of the sharpening member, if a sharpening operation was applied to the image. The valid field codes are -1, 00 to 99. This field is conditional on the SHARP_FLAG field. If the sharpening kernel is not part of the existing group of families and members, then a value of -1 shall be placed in the field and the nature of the sharpening kernel specified in the comment section. Refer to paragraph L.5 of STDI-0002 for a more complete description of the sharpening kernel database.	2	BCS-N	omit	N/A	C

HISTOA TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
MAG_FLAGnn	**Symmetrical Magnification**. This field shall indicate if the image has been symmetrically (same amount in each direction) magnified during this processing step. The valid field codes are 0 and 1. A value of zero means that the image was not magnified. A value of 1 means that the image has been magnified. If this field is equal to 1, then the MAG_LEVEL field shall be filled with the level of magnification.	1	BCS-N	0	N/A	R
The presence of field MAG_LEVELnn is conditional upon MAG_FLAGnn = 1.						
MAG_LEVELnn	**Level of Relative Magnification**. This field shall contain the level of symmetrical magnification that has been applied to the image relative to the input image at this processing step. For example, a value of 02.0000 would indicate a 2X magnification relative to the input image. The valid field codes are 00.0000 to 99.9999. This field is conditional on the MAG_FLAG field. A value greater than 1 shall indicate that the image was magnified to a size larger than its previous size and a value less than 1 shall indicate the image size was decreased. The method of magnification shall be described in the comment section.	7	BCS-N	omit	N/A	C

HISTOA TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
DRA_FLAGnn	**Dynamic Range Adjustment (DRA)**. This field shall indicate if a Dynamic Range Adjustment (DRA) has been applied to the image. DRA is an affine transformation of the image pixel values of the form Y = DRA_MULT*(X-DRA_SUB), where X is the input pixel value, DRA_SUB is the DRA subtractor, DRA_MULT is the DRA multiplier, and Y is the output pixel value. The DRA is said to be spatially invariant when the DRA subtractor and DRA multiplier do not depend on pixel position. If the DRA subtractor and DRA multiplier do depend on pixel position, then the DRA is said to be spatially variant. The valid field codes are 0, 1, and 2. A value of 0 means that a DRA has not been applied to the image. A value of 1 means that a spatially invariant DRA has been applied to the image. In this case, the DRA_SUB and DRA_MULT fields shall be filled with the appropriate codes. A value of 2 means that a spatially variant DRA has been applied to the image. In cases where DRA_FLAG equals 0 or 2, the DRA_SUB and DRA_MULT fields shall not be filled.	1	BCS-N	0, 1, or 2	N/A	R
The presence of fields DRA_MULTnn and DRA_SUBnn are conditional upon DRA_FLAGnn = 1.						
DRA_MULTnn	**DRA Multiplier**. This field shall contain the multiplier value of the DRA. The valid field codes are 000.000 to 999.999. This field is conditional on the DRA_FLAG field being equal to 1.	7	BCS-N	000.000 to 999.999 (in general)	N/A	C
DRA_SUBnn	**DRA Subtractor**. This field shall contain the subtractor value of the DRA. The valid field codes are -9999 to +9999. This field is conditional on the DRA_FLAG field being equal to 1.	5	BCS-N	-9999 to +9999 (in general)	N/A	C

HISTOA TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
TTC_FLAGnn	**Tonal Transfer Curve (TTC)**. This field shall indicate if a TTC (Tonal Transfer Curve) has been applied to the image. The valid field codes are 0 and 1. A value of 0 means that a TTC has not been applied to the image. A value of 1 means that a TTC has been applied to the image. If a TTC has been applied, then the TTCFAM and TTCNUM fields shall be filled with the appropriate codes. Refer to paragraph L.5 of STDI-0002 for a more complete description of the TTC database.	1	BCS-N	0	N/A	R
The presence of fields TTCFAMnn and TTCMEMnn are conditional upon TTC_FLAGnn = 1.						
TTCFAMnn	**TTC Family Number**. This field shall contain the number of the TTC family, if a TTC was applied to the image. The valid field codes are -1, 00 to 99. This field is conditional on the TTC_FLAG field. Although the IDEX TTC family numbers are one-based, many commercial softcopy systems use a zero-based system for their databases. For example, IDEX family 5 would be family 4 for many other softcopy systems. If the TTC is not part of the existing group of families and members, then a value of -1 shall be placed in this field and the nature of the TTC shall be specified in the comment section. Refer to paragraph L.5 of STDI-0002 for a more complete description of the TTC database.	2	BCS-N	omit	N/A	C

HISTOA TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
TTCMEMnn	**TTC Member Number**. This field shall contain the number of the TTC member, if a TTC was applied to the image. The valid field codes are -1, 00 to 99. This field is conditional on the TTC_FLAG field. If the TTC is not part of the existing group of families and members, then a value of -1 shall be placed in this field and the nature of the TTC shall be specified in the comment section. Refer to paragraph L.5 of STDI-0002 for a more complete description of the TTC database.	2	BCS-N	omit	N/A	C
DEVLUT_FLAGnn	**Device LUT**. This field shall indicate if the device compensation LUT has been applied to the image. The valid field codes are 0 and 1. A value of 0 means that a device LUT has not been applied to the image. A value of 1 means that a device LUT has been applied to the image. The nature of the LUT may be specified in the comment section and should include the device for which the LUT is applied. If the device is not known, then an appropriate method for describing the LUT shall be given.	1	BCS-N	0	N/A	R

HISTOA TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
OBPPnn	**Output Bit Depth (Actual)**. This field shall contain the number of significant bits for each pixel after the processing functions denoted in the processing event have been performed, but prior to any output compression. For example, if an 8 bpp image is mapped into Display-Ready space using the proper 8 to 11 bpp transformation (see section L.4 of STDI-0002), then the IBPP field would contain 08 and the OBPP field would contain 11. The OBPP field shall contain the actual number of data bits, not the word length; for example, if an 11-bpp pixel were stored in 16 bits, this field would contain 11. The valid OBPP field codes are 01 to 64, indicating 1 to 64 bpp. In many cases, this field will match the IBPP field.	2	BCS-N	01 to 64 (in general) Ensure that value is consistent with the Image Segment Subheader ABPP value.	bits per pixel	R
OPVTYPEnn	**Output Pixel Value Type**. This field shall contain an indicator of the type of computer representation used for the value of each pixel after the processing functions denoted in the processing event have been performed, but prior to any output compression. Valid entries are INT for integer, B for bi-level, SI for 2's complement signed integer, R for real, U for user-defined, and C for complex. The data bits of INT and SI values shall appear in the file in order of significance, beginning with the MSB and ending with the LSB. INT and SI data types shall be limited to 16 bits. R values shall be represented according to the IEEE 32-bit floating-point representation (IEEE 754). C values shall be represented with the Real and Imaginary parts each 32-bit floating-point representation (IEEE 754) and appearing in adjacent 4-byte bocks, first Real, then Imaginary. B (bi-level) pixel values shall be represented as single bits with the value 1 or 0.	3	BCS-A	alphanumeric (in general) INT, B, SI, R, C, U Ensure that value is consistent with the Image Segment Subheader PVTYPE value.	N/A	R

HISTOA TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
OUTBWCnn	**Output Bandwidth Compression**. This field shall indicate the type of bandwidth compression or expansion that has been applied to the image after any enhancements denoted in the processing event. The valid field codes to describe each type of compression are 5-byte character strings. The first two characters indicate the type of compression such as DCT or DPCM. The next two characters indicate either the bit rate of the quality level. The last character indicates if the process is compression or expansion. Compression is denoted by a C, an E denotes expansion, and 0 indicates that neither process occurred. The types of compression are indicated by the same codes used in the INBWC field and can be found in the field description for INBWC. The entire OUTBWC field is 10 bytes long to allow for the concatenation of up to 2 compression algorithms. Two consecutive 5 byte character strings shall indicate the application of two compression algorithms in succession. If only one operation is performed, then the remaining 5 characters are zero. Examples of valid codes for the OUTBWC field are shown below. The NJQ1C00000 code indicates that the processed image was saved as a NITFIRD JPEG compressed image at quality level 1. The NJNLC00000 code indicates that the processed image was saved as a NITFIRD JPEG lossless compressed image.	10	BCS-A	NONE000000 (indicates No Compression) J2NL000000 (indicates JPEG 2000 Numerically Lossless Compression	N/A	R

HISTOA TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
	The C3Q3C00000 code indicates that the processed image was saved as a NITFS JPEG compressed image at quality level 3.					
End of Processing Event Loop.						

4.1.8 MSTGTA TRE for LiDAR Products

The Mission Target Information support extension (MSTGTA) is contained in the extended subheader data section of the NITF2.1 Image Segment Subheader. This tagged record extension may be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Image Segment Subheader. Table 4.1.8-1 provides the field descriptions and metadata population requirements for MSTGTA TRE used with LiDAR datasets. The use of this TRE is optional for all such datasets.

For additional information refer to *STDI-0002, The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITFS).*

Table 4.1.8-1: MSTGTA TRE Fields for LiDAR Products.

MSTGTA TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	MSTGTA	N/A	R
CEL	**Length of CEDATA**. This field contains the length, in bytes, of the data stored in the TRE, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	00101	bytes	R
TGT_NUM	**Pre-Planned Target Number**. This field shall contain the number assigned to each pre-planned target, initialized at 00001. Recorded in the mission target support data block and the mission catalog support data block to associate the two groups of information. The same number may be assigned to multiple mission catalogs support blocks. Each mission target block shall have a unique number. 00000 = TRE is empty.	5	BCS-N	00000, 00001 to 99999	N/A	R
TGT_ID	**Designator of Target**. This field records the twelve-character target designator.	12	BCS-A	alphanumeric (in general) Default is all BCS spaces (0x20)	N/A	<R>
TGT_BE	**Basic Encyclopedia ID/OSUFFIX**. This field records the ten-character BE number of the target followed by the five-character OSUFFIX for the target.	15	BCS-A	BBBBBBBBBBOOOOO, BBBBBBBBBB (where blank-fill is used for the OSUFFIX if it is unknown) Default is all BCS spaces (0x20)	N/A	<R>
TGT_PRI	**Pre-Planned Target Priority**. This field records the pre-planned priority of the target. 001 = top priority 002 = second priority, etc.	3	BCS-A	001 to 999 Default is all BCS spaces (0x20)	N/A	<R>

MSTGTA TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
TGT_REQ	**Target Requester**. This field identifies the authority requesting the targets to be imaged.	12	BCS-A	alphanumeric (in general) Default is all BCS blanks (0x20)	N/A	<R>
TGT_LTIOV	**Latest Time Information of Value**. This field shall contain the date and time, referenced to UTC, at which the information, contained in this file, loses all value and should be discarded. The date and time is in the format CCYYMMDDhhmm where CC is the century, YY is the year, MM is the month (01-12), DD is the day of the month (01-31), hh is the hour (00-23), and mm is the minute (00 to59).	12	BCS-A	CCYYMMDDhhmm Default is all BCS spaces (0x20)	UTC	<R>
TGT_TYPE	**Pre-Planned Target Type**. This field identifies the type of pre-planned target. 0 = point 1 = strip 2 = area 3 to 9 = reserved	1	BCS-A	0 to 9 (in general) Default is a BCS space (0x20)	N/A	<R>
TGT_COLL	**Pre-Planned Collection Technique**. This field identifies the pre-planned collection technique. 0 = vertical 1 = forward oblique 2 = right oblique 3 = left oblique 4 = best possible 5 to 9 = reserved	1	BCS-N	0 to 9 (in general)	N/A	R

MSTGTA TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
TGT_CAT	**Target Functional Category Code from DIAM-65-3-1**. This field contains the five-character numeric code that classifies the function performed by a facility. The data code is based on an initial breakdown of targets into nine major groups, identified by the first digit: 1 = Raw Materials 2 = Basic Processing 3 = Basic Equipment Production 4 = Basic Services, Research, Utilities 5 = End Products (civilian) 6 = End Products (military) 7 = Places, Population, Gov't 8 = Air & Missile Facilities 9 = Military Troop Facilities Each successive numeric character, reading from left to right, extends or delineates the definition further.	5	BCS-A	10000 to 99999 Default is all BCS spaces (0x20)	N/A	<R>
TGT_UTC	**Planned Time at Target**. This field shall record the planned time at target in UTC. The format is hhmmssZ where, hh = hours (00-23), mm = minutes (00-59), ss = seconds (00-59), and Z = the UTC time zone.	7	BCS-A	hhmmssZ Default is all BCS spaces (0x20)	UTC	<R>
TGT_ELEV	**Target Elevation Above MSL**. This field shall contain the planned elevation of the target above Mean Sea Level (MSL) for point targets. For strip and area targets, this field shall contain the average elevation of the target area above MSL. The value is recorded in either feet or meters, as specified by TGT_ELEV_UNIT.	6	BCS-A	-01000 to +30000 Default is all BCS spaces (0x20)	feet or meters	<R>
TGT_ELEV_UNIT	**Unit of Target Elevation**. This field contains the units of the elevation value recorded in TGT_ELEV. f = feet m = meters	1	BCS-A	f or m Default is a BCS space (0x20)	N/A	<R>

MSTGTA TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
TGT_LOC	**Target Location**. This field shall contain the planned latitude/longitude of the portion of the target corresponding to the point where the elevation was measured or the point associated with the average elevation for strip or area targets. Location may be expressed in either degrees-minutes-seconds or in decimal degrees. The format ddmmss.ssX represents degrees (00-89), minutes (00-59), seconds (00-59), and hundredths of seconds (00-99) of latitude, with X=N for north and S for south, and dddmmss.ssY represents degrees (000-179), minutes (00-59), seconds (00-59), and hundredths of seconds (00-99) of longitude, with Y=E for east and W for west. The format ±dd.dddddd indicates degrees of latitude (north is positive), and ±ddd.dddddd represents degrees of longitude (east is positive).	21	BCS-A	ddmmss.ssXdddmmss.ssY, ±dd.dddddd±ddd.dddddd	degrees	R

4.1.9 PIATGB TRE for LiDAR Products

The Profile for Imagery Access Target support extension (PIATGB) is contained in the extended subheader data section of the NITF2.1 Image Segment Subheader. This tagged record extension may be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Image Segment Subheader. Table 4.1.9-1 provides the field descriptions and metadata population requirements for PIATGB TRE used with LiDAR datasets. The use of this TRE is optional for all such datasets.

The PIATGB TRE contains metadata indicating the Country Code, which may be useful for image search and discovery.

For additional information refer to *STDI-0002, The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITFS).*

Table 4.1.9-1: PIATGB TRE Fields for LiDAR Products.

PIATGB TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	PIATGB	N/A	R
CEL	**Length of CEDATA**. This field contains the length, in bytes, of the data stored in the TRE, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	00117	bytes	R
TGTUTM	**Target UTM**. Identifies the Universal Transverse Mercator (UTM) grid coordinates that equate to the geographic coordinates of the target element.	15	BCS-A	XXXNNnnnnnnnnn		O
PIATGAID	**Target Identification**. Identifies a point or area target (DSA, LOC or BAS).	15	BCS-A	6 character Area Target ID 10 Character BE, or 15 character BE + suffix		O
PIACTRY	**Country Code**. Identifies the country in which the geographic coordinates of the target element reside.	2	BCS-A	FIPS 10-4		O
PIACAT	**Category Code**. Classifies a target element by its product or the type of activity in which it can engage.	5	BCS-A	DIAM 65-3-1		O
TGTGEO	**Target Geographic Coordinates**. Specifies a point target's geographic location in latitude and longitude.	15	BCS-A	ddmmssXdddmmssY		O
DATUM	**Target Coordinate Datum**. Identifies the datum of the map used to derive the target coordinates (UTM or GEO).	3	BCS-A	In accordance with Appendix B, Attachment 10, XI-DBDD-08 93 Aug 93		O
TGTNAME	**Target Name**. Identifies the official name of the target element based on the MIIDS/IDB name.	38	BCS-A	alphanumeric target names		O
PERCOVER	**Percentage of Coverage**. Percentage of the target covered by the image.	3	BCS-A	000 to 100		O

PIATGB TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
TGTLAT	**Target Latitude**. Specifies a point target's geographic location in latitude (in decimal degrees).	10	BCS-A	+dd.dddddd - where "+" is northern hemisphere and "-" is southern hemisphere. NOTE: Provide the value only to the decimal places (precision) warranted by the sources and methods used to determine the location. The remaining places will be blank.	degrees	O
TGTLON	**Target Longitude**. Specifies a point target's geographic location in longitude (in decimal degrees).	11	BCS-A	+ddd.dddddd - where "+" is eastern hemisphere and "-" is western hemisphere. NOTE: Provide the value only to the decimal places (precision) warranted by the sources and methods used to determine the location. The remaining places will be blank.	degrees	O

4.1.10 J2KLRA TRE for LiDAR Products

The JPEG 2000 Layer Target Bit Rates tagged record extension (J2KLRA) is contained in the extended subheader data section of the NITF2.1 Image Segment Subheader. This tagged record extension should not be overflowed to a TRE_OVERFLOW DES, should overflow be required from the NITF2.1 Image Segment Subheader. Table 4.1.10-1 provides the field descriptions and metadata population requirements for J2KLRA TRE used with LiDAR datasets. This TRE is required for all such datasets that make use of JPEG 2000 compression.

Table 4.1.10-2 provides the target bit rate values for each Quality Layer in the JPEG 2000 compressed codestream.

The target bit rate values provided in this table have not been optimized for LiDAR systems. The values may be used until such time as additional research identifies LiDAR-specific values. As such, these values are to be considered as **TBR01**.

The J2KLRA TRE is required for JPEG 2000 Compressed Imagery.

For additional information refer to *BPJ2K01.10, BIIF Profile for JPEG 2000.*

Table 4.1.10-1: J2KLRA TRE Fields for LiDAR Products.

J2KLRA TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
CETAG	**Unique Extension Identifier**. This field contains the 6-character string that identifies the name of the controlled tagged record extension (TRE).	6	BCS-A	J2KLRA	N/A	R
CEL	**Length of CEDATA**. This field contains the length, in bytes, of the data stored in subsequent TRE fields, excluding the eleven bytes associated with the CETAG and CEL fields.	5	BCS-N	00023 to 00261	bytes	R
ORIG	**Original Compressed Data**. This field shall indicate the encoding profile used during the compression of the JPEG 2000 codestream and whether the codestream has been parsed or not. Codestream parsing can be accomplished in resolution level, quality layer, spatial extent (spatial chipping), and/or component (spectral band). The conditional fields (NLEVELS_I, NLAYERS_I, and NBANDS_I) are present if this field indicates a parsed codestream. Note: If a codestream has been transcoded from one profile to another (e.g. NPJE to EPJE), then the ORIG field shall be updated for use with the transcoded codestream to reflect the encoding profile now in effect.	1	BCS-N	0 – Original NPJE 1 – Parsed NPJE 2 – Original EPJE 3 – Parsed EPJE 4 – Original TPJE 5 – Parsed TPJE 6 – Original LPJE 7 – Parsed LPJE 8 – Original other 9 – Parsed other	N/A	R
Original compressed image information (the first JPEG 2000 compression).						

J2KLRA TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
NLEVELS_O	**Number of Wavelet Levels in Original Image**. This field shall indicate the number of wavelet decomposition levels provided in the original image codestream. Note that the number of Reduced Resolution Dataset (RRDS) images contained in a codestream is equal to one plus the number of decomposition levels recorded in this field.	2	BCS-N	00 to 32 (in general)	N/A	R
NBANDS_O	**Number of Bands in Original Image**. This field shall indicate the number of bands (components) in the original image codestream.	5	BCS-N	00001 to 16384 (in general)	N/A	R
NLAYERS_O	**Number of Layers in Original Image**. This field shall indicate the number of layers in the original image codestream.	3	BCS-N	001 to 999 (in general)	N/A	R
Start of layer target bit rate information loop. Field repeats for n = 0 to NLAYERS_O-1 times.						
LAYER_IDn	**nth Layer ID Number**. This field indicates the index number of the layer target bit rate being described. Layers are numbered from 0 to NLAYERS_O-1. 0 is the layer with the lowest bit rate.	3	BCS-N	000 to 998 (in general)	N/A	R
BITRATEn	**nth Bit Rate**. This field shall indicate the accumulated bit rate target associated with this and associated lower layers. This is defined in bits per pixel per band (bpppb). It may happen that the bit rate was not achieved due to data characteristics. Note for JPEG 2000 numerically lossless quality, the bit rate for the final layer is an expected value based on past performance. If there is not a target bit rate, report the achieved bit rate.	9	BCS-A**	00.000000 to 37.000000* See Table 4.1.10-2 for listings of actual Layer Target Bit Rates to be used.	bpppb	R
End of layer target bit rate information loop.						
Start of conditional fields for parsed datasets (ORIG = 1, 3, 5, or 9).						

J2KLRA TRE Fields for LiDAR Products						
FIELD NAME	**DESCRIPTION**	**SIZE**	**DATA TYPE**	**VALUE RANGE**	**UNITS**	**TYPE**
NLEVELS_I	**Number of Wavelet Levels in This Image**. This field shall indicate the number of wavelet decomposition levels included in this image codestream as defined in the JPEG 2000 codestream COD marker (see ISO/IEC 15444-1:2004).	2	BCS-N	00 to 32 (in general)	N/A	C
NBANDS_I	**Number of Bands in This Image**. This field shall indicate the number of bands in this image as defined in the JPEG 2000 codestream SIZ marker (see ISO/IEC 15444-1:2004).	5	BCS-N	00001 to 16384 (in general)	N/A	C
NLAYERS_I	**Number of Layers in This Image**. This field shall indicate the number of layers in this image as defined in the JPEG 2000 codestream COD marker (see ISO/IEC 15444-1:2004).	3	BCS-N	001 to 999 (in general)	N/A	C

*The component sample precision is limited by the number of guard bits, quantization, growth of coefficients at each decomposition level, and the number of coding passes that can be signaled. Not all combinations of coding styles will allow the coding of 38 bit samples per band (see BPJ2K01.10).
** The official definition of the J2KLRA TRE has the BITRATEn field format listed as BCS-A (see BPJ2K01.10).

Table 4.1.10-2: JPEG 2000 Target Bit Rate Layers.

JPEG 2000 Target Bit Rate Layers		
Quality Layer	**Visually Lossless Compression (9-7I)**	**Numerically Lossless Compression (5-3R)**
0	**0.03125** bpppb	**0.03125** bpppb
1	**0.0625** bpppb	**0.0625** bpppb
2	**0.125** bpppb	**0.125** bpppb
3	**0.25** bpppb	**0.25** bpppb
4	**0.5** bpppb	**0.5** bpppb
5	**0.6** bpppb	**0.6** bpppb
6	**0.7** bpppb	**0.7** bpppb
7	**0.8** bpppb	**0.8** bpppb
8	**0.9** bpppb	**0.9** bpppb
9	**1.0** bpppb	**1.0** bpppb
10	**1.1** bpppb	**1.1** bpppb
11	**1.2** bpppb	**1.2** bpppb
12	**1.3** bpppb	**1.3** bpppb
13	**1.5** bpppb	**1.5** bpppb
14	**1.7** bpppb	**1.7** bpppb
15	**2.0** bpppb	**2.0** bpppb
16	**2.3** bpppb	**2.3** bpppb
17	**2.8** bpppb	**2.8** bpppb
18	**3.5** bpppb	**3.5** bpppb
19		**all remaining bits**